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EDITORIAL NOTES.

Gas Purity, Residuals Quality, and Coal Prices.

THE keynote of the address that the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter, D.Sc.) delivered to the proprietors on Wednesday last was "good "service"—good service not only to the gas consumers, but to all who are customers for any of the commodities in which the Company deal. There is foresight in the policy of good service. It may cost money; but it means the best possible protection of interests present and future that the proprietors, employee co-partners, and consumers can have. Good service as a policy is a very material thing with the Company; and it is carried out to a fine degree in every department of the business. The Chairman (who, as Mr. Doig Gibb deliberately stated at the meeting, is the mainspring of all this work) and his colleagues have a right to claim, and receive, credit for what they are doing. Their policy in this regard is a matter upon which the proprietors and the consumers should be informed; and therefore the Chairman (at the risk of his words being outside the meeting accounted a little boastful) did the correct thing in talking of what the Board and the officials are doing in promoting the interests of the undertaking. The course that they are pursuing in this respect is the right one.

Quality (at a reasonable price) appropriate to use is the foundation of lasting commercial enterprise. In regard to gas supply, the Chairman claimed that the gas distributed by the Company is not only of the highest heating and lighting value of any Metropolitan gas supply, but is of the greatest purity. But though the position held to-day in the matter of purity is a high one (it was not always so), there is not complete satisfaction on the part of the present administration. If Parliament required any illustration that, in such a business as that of gas supply there are, in competition, and in the sense of administrative responsibility, all the safeguards that consumers need, without the concerns being tied down to rigorous rule and official ward, they would have it in the history of this purification question in connection with the South Metropolitan Gas Company. The Company and Sir George Livesey took the lead in attacking the continuance of the enactments relating to sulphur compounds, and obtained the verdict which secured the right to all gas undertakings to procure the repeal of the unnecessary specific limitations. But for long past, the Company have been working hard, by incessant investigation and expenditure, to develop a process (free from the nuisance attaching to the old lime system) whereby the sulphur content of their gas should stand lower than it ever did before the repeal of the sulphur clauses other than those relating to sulphuretted hydrogen. They have reached what the Chairman intimates may be described as an assured success; and by the at present partial aid of the process, combined temporarily with a reversion to lime purification, he can now claim that the gas supplied by the Company is of greater purity than that of any other in the Metropolitan area. The new system (which it is now well-known consists of plant in which the gas, preheated, is brought into contact with a heated surface, and the carbon disulphide is converted into sulphuretted hydrogen, which is removed by the oxide purifiers) is to be applied to the whole of the gas output of the Company; and, when this is done, to use Mr. Carpenter's own words, "we shall be making "and supplying gas which has, I think I may say, *never, in "the history of gas lighting, been equalled for the purity which "we shall attain.*" This, while good news for the consumers, has a note of challenge about it. At any rate, it looks as though the Company are going to set up a new standard in this connection, and to show how it is to be realized. However, the Chairman did not hide the fact that there have been difficulties to contend with in perfecting the process. That is not an unusual experience with revolutionary processes—processes that are a complete departure from almost universal practice, and in association with which there is little previous guiding work. The difficulties, however, have not affected principle, but are wholly matters of detail. It is satisfactory to learn this, and especially that the way is clear to surmounting them by the application of the process to all the other stations, at the same time, through the working experience gained at the Old Kent Road, ensuring a considerable reduction in the cost of installation. There has been a large expenditure on the plant at Old Kent Road; but the future is going to benefit from it. When the whole of the gas output of the Company is being treated by the new process, there will be a narrow watching of the official returns so as to see whether the claim to a hitherto unequalled purity will be justified.

From gas, we turn to residuals. Here, again, the Chairman claims that "by careful attention to quality, we are "able to supply higher grade articles than was at one time "the case." "Our make of coke is now a standard one, "and is specified by buyers." "Our tar and ammonia "products are of the highest market quality, and command "favourable prices on that account." "Our anthracene is "considered of the highest standard quality in Great "Britain." The extracts are sufficient indication of the "good service" policy having been applied to all departments of the Company's manufacturing operations. For part of the advantage in quantity and quality in the residuals department, credit is given to the improvement in carbonizing methods. For instance, the quantity of benzol now produced is double, per ton of coal, what it was a decade ago. Talking of benzol, it is sincerely to be hoped that the rumour is inaccurate that the Government intend to put a tax upon it; for, as Mr. Carpenter says, it would be most unfortunate if steps were taken which would discourage the production of a home-made motor spirit.

On previous occasions, there have been references to the large amount of work the Company do in keeping in good operating order the gas-appliances on the premises of consumers. This work has borne, and is continuing to bear, good fruit. The Chairman did not dwell much upon this particular matter on the present occasion. Nevertheless it takes an important place in the "good service" policy of the Board; and the extent of the new connections is an index to the favour in which are held the Company's cheap gas supply, and the business conditions existing between them and residents in their large area. The Chairman did not dwell at any length upon the financial results or on the increased gas business of the half year. His greatest concern, as of all gas administrators at the present time, is the price of coal, and its relation to the maintenance of a low price for gas. These were the subjects that stood in the forefront of the address, though we have, in our reference to the proceedings here, transposed the sequence of subject-matter in order to give prominence to questions of a technico-commercial character, for the technical policy is not by any means an unimportant factor in a permanent commercial success. The Chairman has been looking back for precedent for the present high prices of gas coal, which he finds are altogether unjustified. The Company are paying about 15s. per ton on board ship in the North; and going back twenty five years, he can only find one occasion on which this price has been equalled. That was in 1900; and then, as in 1873, the high price was due to activity in the iron and steel trades. The high price of 1900 was succeeded by a 40 per cent. drop; and the Chairman sees no reason why history should not repeat itself, although he hesitates to say that it will. We are rather afraid the conditions of 1900 are not on parallel lines with those of 1913. The coalowners, at the present time, have everything in their favour for upholding prices, through the extraordinary circumstances of the past twelve months on top of which trade has been at a high level. There is no doubt the coalowners have been working, and have been assisted by circumstances, for a higher normal level of prices than has hitherto

existed under any given set of circumstances. They are justified in expecting something more than under the conditions existing before the new mining legislation came into force; but they are not entitled to the irrational gas coal prices of the present. However, narrating to the owners the position of the gas industry as compared with other industries will not, we fear, do much towards gaining their special sympathy and consideration. For reasons set out in Mr. Carpenter's speech, but which we will not repeat here, gas companies must hesitate in these days to do what other industries can readily do—raise the price of their staple commodity. Every effort must be made to avert that. Gas business and residuals have been kindly disposed so far during the run of the high coal prices; but as the gas and residuals business relies in a not inconsiderable part upon climatic and trade conditions, there is no assurance that in these directions the level of prosperity will be continuously maintained. Our climate is too erratic, and therefore unreliable, a base for any forward estimating. To coal, the industry looks for relief from the necessity of raising the charges for gas. Mr. Carpenter believes it is impossible that coal prices can remain very much longer at the present high figures. They cannot have further great duration, but there are no signs of an immediate recession for purchases apart from current contracts. Of this, however, we may be assured, that only extraordinarily abnormal circumstances could weaken conditions to such an extent as to cause coal prices ever to recede again to such figures as Sir George Livesey referred to at the meeting of the proprietors in February, 1907. The levels of prices under all conditions have been raised permanently. But industry looks and hopes for much better conditions, and those not far ahead.

Joint Committee's Voting on the Residuals Report.

A Blue Book has been issued reporting *in extenso* the proceedings before the Joint Committee of the two Houses of Parliament who sat to consider the question, raised by the chemical manufacturers, as to whether or not there should be any restriction imposed on the gas industry in relation to their dealings in the residual products of gas manufacture. The lengthy report of the proceedings that was published in the "Journal" showed the thoroughness with which the Committee considered the whole bearings of the proposed limitation; and on that thorough consideration they arrived at a decision adverse to the chemical manufacturers, and completely favourable to the gas industry. The Blue Book presents with still greater emphasis the thoroughness of the Committee's investigation. With their own report, the minutes of their private conferences, and eight appendices, the report of the evidence and the speeches of Counsel occupy 201 foolscap pages. This exhaustive consideration gives weight to their verdict, which verdict has received the endorsement in the Press of all followers of movements of public interest who were in the position to take an impartial view of the matter.

The satisfaction that was given to the gas industry by the publication of the Committee's findings will be intensified on learning, as we now do, from the minutes of the private proceedings of the Committee, the measure of unanimity with which they passed the report, the draft of which was prepared by the Chairman (Mr. J. W. Hills) after conference with his fellow members. When the draft report was considered, there were nine members out of the ten present; and every clause of the report was agreed to without challenge, save clause 10. That was the vital one. It reads: "They consider further that one gas undertaking should "be allowed to purchase the residuals of other gas under-"takings, in order to manufacture other products of the "same kind as the purchasing undertaking is manufac-"turing from its own residuals, but this is subject to the "qualification contained in paragraph 12." The qualification is merely that the Committee are of opinion that gas undertakings should not be allowed to manufacture chemicals exclusively from raw materials bought from others than gas undertakings, or in the manufacture of which the use of residuals produced by themselves, or bought from other gas undertakings, is merely subsidiary. Clause 10 was challenged by Mr. Samuel Roberts. He proposed that it should be amended as follows: "The Committee consider that pur-"chase of residuals on a larger and systematic scale from "one gas company to another should not be permitted, as "being outside the powers granted or contemplated by "Parliament. They think, however, that such purchases "should be allowed in 'emergency' cases, so that the ordi-"nary and legitimate business of gas undertakings may not "be interfered with or interrupted. They are also of opinion "that exceptions may be properly made in the cases of "small undertakings where the plant is wanting or insuffi-"cient." The passing of this amendment would have had all the effect that would have crippled free trading in the gas industry's secondary commodities. But Mr. Roberts fortunately found himself in a state of isolation. The Committee did not regard favourably anything embraced in the amendment. And Mr. Roberts saw it discarded by the other members of the Committee; and their solid vote cast for free trading among gas undertakings in the residuals of gas manufacture.

The knowledge of this incident is most valuable, and, as already said, will intensify the satisfaction of the industry with the verdict of the Committee.

The Year's Special Engagements.

This year ought to be one that will bring the technical and commercial position of the gas industry well into prominence before the world generally. Last year gave a good start in producing this prominence, through both the celebration of the centenary of the Gaslight and Coke Company and the meeting in Manchester of the British Commercial Gas Association. The gas industry hitherto has evinced rather a retiring disposition in the matter of publicity of a kind apart from trading publicity. It has been a large public servant, quietly prosecuting its technical and commercial work, and building up a vast business and a prosperity that are the envy of some other industries. But though it has taken such a substantial part in the work of the world, it has always kept itself very much in the background. There has been no ambition to be better known; and the consequence is there is not that recognition of the industry in public places and by public bodies to which an industry of such magnitude is entitled. Here we are in the Jubilee Year of the central professional organization of the industry; but the Institution has never done anything of importance to gain publicity and recognition in the same way that many other and among them younger bodies have done. The younger bodies that we have in mind have their annual dinners. Men of position and influence in the world's affairs honour them by being present on such occasions, and deem it an honour to receive from them an invitation. The result is that the Daily Press report the event, and give the world an account of the post-prandial sayings of men of whose words the public takes heed. This engenders public recognition.

This Jubilee Year of the Institution ought to be the starting-point for getting out of the old rut in a road which is as secluded as the gated thoroughfare, with "Private" in large letters at one or both ends, and boards giving notice that "Trespassers will be Prosecuted." This sort of thing in connection with a professional organization attached to a public trading industry is old-fashioned and to-day impolitic. The time is opportune for a change; and we hope the Jubilee Year and the presidency of Sir Corbet Woodall will see a permanent change in this matter of gaining publicity and greater recognition, by providing opportunities for bringing into touch with the gas industry men of influence who are not of the industry. The value of this is plain. There are, we think, signs that the Council of the Institution are recognizing the backwardness of the body in this particular, as compared with most other professional organizations. But whether this be so or not, they are doing the right thing in connection with the Jubilee Year celebrations. The Council, at their meeting last Tuesday, had under consideration the preliminaries for the programme of the annual meeting; and they are to be heartily congratulated on the promise that we have of a meeting and engagements, from June 17 to 20, worthy of the Jubilee event. We are not by any means prepared to place the dinner that it has been decided to hold on the Wednesday evening as the *pièce de résistance* of the week; but we do give it prominence in relation to the point that the Institution should not permit itself and the industry to which it is attached to be overshadowed, by neglecting a legitimate means—made use of by similar organizations, and free to all—of securing publicity and outer recognition. For the most part, members of the Institution can well afford an annual function of this kind. Regarding the meeting generally, it will be recognized that there is very special significance about it this year; and what may be done in other respects

on this occasion cannot possibly be the standard for the Institution to live up to for all future time. For example, instead of the ordinary excursion on the Friday, the members of the Institution and their ladies will be the guests of Sir Corbet and Lady Woodall at a garden party at Chislehurst. The proposal that this should be an item in the week's celebrations has been cordially accepted by the Council in the name of the members; and, when the time comes, the members themselves will show their appreciation of the kindly thought in the manner that we know will give the greatest possible satisfaction to the President and Lady Woodall.

Concerning more prosaic matters, the business meetings also promise to be of high order in point of interest, general and particular. There will be the Presidential Address. Speaking of this, may we make a suggestion to the Council? It is that, this being the Jubilee Year of the Institution, those members who were present at the first meeting of the British Association of Gas Managers, or took part in the inception of the Association, and who are still with us, and can be in London at the time, should be accommodated with seats on the opening day on the daïs alongside the President. This will be, we take it, the time when the veteran gas engineer, Mr. Thomas Newbigging, will be presented with his portrait in oils. We know the members of the Council appreciate the honour of supporting the President at the opening meeting; but this is a special and eventful occasion. And we feel sure the members generally would like to see the men—the "Boys of the Old Brigade," if we may venture to use a designation which among Britishers betokens regard—who link with the present those now far-off days when the Association was founded, given a place of honour at the meeting. We see that another incident of the first morning's meeting will be, if the Council's nomination is accepted, as we are sure it will be, the presentation of the Birmingham Medal to Sir Corbet. The members of the profession will be glad to see the name of their Jubilee President added to this particular roll of honour. Regarding the technical proceedings, there is a hint given, in the notes to hand of last Tuesday's Council proceedings, that there are already members who desire to have part in contributing to the Jubilee meeting. "Several offers of papers for reading "were reported." But if there is a plethora of contribution, it is hoped the Council will make a judicious selection, rather than have the proceedings injured by trying to squeeze too much into the three sittings. There are the lessons of the past; and, on this occasion, there will be more items of peculiar interest to engage attention. We are confident it will be a common desire that the forthcoming meeting should be regarded as, and made as far as possible, something out of the ordinary.

With the annual meeting of the Institution in June, the celebrations will not end. These are to be continued in October, when the National Gas Exhibition will be held at Shepherd's Bush. To this we are all looking forward as being one of those somewhat rare and more difficult to organize events, which give an industry such as gas supply an all-round publicity. Upon the display more talent than ever the industry has possessed before for public displays is being concentrated, and this under the auspices of combined interests, in the bringing into being of which combination we can certainly claim having had an initial part. Everything promises for success, and that success is being promoted by looking upon the exhibition as one having an industrial object rather than solely individual benefit.

The Alliance of Gas and Electricity Supplies.

THERE was assent in last week's issue to the proposition presented in Mr. C. H. Wordingham's article—a proposition to which parliamentary effect has already been given in the case of certain gas undertakings—that, under favourable conditions, the amalgamation of gas and electricity supplies is a politic action. So far, except upon trivial points, Mr. Wordingham and ourselves are in accord. It is now our business to deal with the statement which prefaced the political proposition; and, in doing so, we may say that this article is addressed more to those outside the gas industry than to those within it. It must at once be said that we are somewhat surprised that one in the position, and with the vast experience, of Mr. Wordingham in the electrical world should know so little of the current means of utilizing gas, and of the merits of those means. One would, reading the first part of his article, imagine him to be of opinion that the advent of electricity into daily use was the correction by Nature of an error in presenting the world with such an economical agent as gas for the production of light, heat, and power. We will take our friend on his own ground when he remarks: "No permanent measure of success can "ever attend pushing a business unless real merit lies "behind the claims made." The gas industry has now 100 years' record as a statutorily controlled industry; and for one-third of the time, it has had electricity as a competitor. During the years of competition, the gas industry has more than doubled its business. The merits of the means of utilizing its staple product have been enhanced more in the past few years than during any preceding period; and in the past year, as Mr. Wordingham will see if he studies the accounts already issued, the extension of business was greater than ever. Most gas undertakings can now show electricity consumers who, through the merits of the gas industry's modern appliances, and through the shortcomings of electricity supply (reference to which is carefully avoided by our contributor), have reverted to gas.

With the light air of the partially instructed, Mr. Wordingham gravely gives expression to what he believes to be facts concerning gas lighting. It is an old electrical fallacy that, even when maintained with the best expert knowledge, the most modern gas-burners "rapidly drop in candle power "by a heavy percentage, so that the test figures for gas con-"sumption are soon largely exceeded." That is untrue. With the old upright gas-burner, there was deterioration of mantles through swaying on their supports which caused rupture and deformation, and so upset the proper relationship of the flame and the light-radiating medium. But that cannot be alleged against the modern inverted mantle with suspension from a rigid support. The conditions have been altogether changed. There are in the place in which this article is being written, inverted burners that have been in constant use daily since the first week in March last; and the mantles that were then installed have not so far been removed from the burners, and there is no intention of removing them, for there has been no "heavy percentage" depreciation of light. Mr. Wordingham is, as we have said, an engineer of high position in the electrical world; and as he has supplied the ground for controversy in his article, we will ask him to explain what are the constituents of a mantle that contribute, and that are vital, to its light-giving value that deteriorate by exposure to a gas-flame—if he likes, the high-temperature flame of a high-pressure lamp. Following on, Mr. Wordingham is of the opinion that it is a sign of a weak case for gas engineers to talk of the "wholesomeness" of gas for illumination. This critic of gas illumination will not at any rate be so absurd as some of the less informed of electrical critics in asserting that gas burning in a room does not cause a beneficial movement of the atmosphere; or in saying that there is in a gas-lighted room an inversion of a natural order of things, which prevents the heated air rising, and so the natural order of things cannot be made to assist in the ventilation of gas-lighted rooms. As a matter of fact, the gas-burner is a very efficient vehicle in ventilation (without mechanical means), if people will only use a little common sense. But concerning the "wholesomeness," Mr. Wordingham has voluntarily made a statement which gives us the right to ask him what is there resulting from the atmospheric flame of a domestic burner, in the proportions that the products bear to the chemical constitution of the atmosphere, that is *unwholesome?* We are prepared to discuss this point with our contributor on chemical grounds, and in relation to effects on the human being. It is only fair that, having made the charge in the terms that he has done, he should state specifically (not generally) the reasons for his "real belief," which is opposed to the "real belief" of those who do not indulge in generalities, but have made actual investigation.

This is a hygienic matter. There are other hygienic matters. Mr. Wordingham has been talking about "real "merit." Mr. Thorne Baker, Sir Ray Lankester, and many other authorities have stated, and it is generally known by those who have studied the question, that the spectrum composition of gaslight more nearly approaches that of sunlight than does that of electric light. Without going further back for authorities (and, forsooth, we have a substantial bunch of them), Dr. W. Ettles has advised that metallic filaments should be enclosed in coloured glass bulbs, so as to neutralize the eye-injuring effects of the extreme violet end of the spectrum. If, further, Mr. Wordingham has studied the question of the relative intrinsic brilliancy of the

metallic filament lamp and of the gas mantle, he will admit that that of the former is many times greater than that of the latter per unit of incandescent area. He will also know that high intrinsic brilliancy is not good for the organs of sight. He talks of "real merit." He must admit, unless he is prepared to run his head against a wall of irrefragable fact, that the "real merit" of quality of light lies not with the electrical means of illumination, but with those of gas. Also most important is the fact that the public are learning of these things. Only recently we met a bank clerk who works under the light of metallic filament lamps all day, and has lately had to consult an oculist. Now he says that he would not change his incandescent gas-lights at home, not even if the electrical people offered to illuminate his house free. A business man who is compelled, owing to the deficient natural lighting of his premises, to use artificial light practically all day, informs us that he is glad to get home of an evening to his gas-lighted rooms, and rest his eyes; and he is now considering the question of the installation of gas in the office part of his business premises. Mr. Wordingham has to face this growth of public knowledge, born not of electrical literature, but of personal experience. His insinuation that merit is all on the side of electric lighting will not bear investigation. There are means, we are fully aware, of overcoming the defects of electric lamps, but at an increased cost for installation, and not at 1·2 watt-hours per candle. The cure increases cost; and our contributor says (though it is not true) that "in "every case the determining factor is cost." While on the point of intrinsic merit, we should like to observe that, contrary to the critic, we cannot trace a single improvement in gas appliances that is due to the competition of electric lighting. What we can trace is that the gas industry has been stirred up by competition into making good use of the advances in gas lighting that science has effected.

We pass from hygienic considerations to efficiencies and costs. There is the old electrical exaggeration in this part of the article. We are talking now of modern electric lamps and modern gas-lamps; and not of modern electric lamps and old gas-lamps. Gas engineers would be exceedingly dissatisfied if it were the fact that 0·083 cubic foot of gas was required per hour per candle. The inverted gas-lamp of to-day (which, by the way, gives a high candle power at all angles below the horizontal, and does not dissipate a large amount of its light above the horizontal, as does the metallic filament lamp unless a reflector is used) easily gives 1 candle power for a consumption of 0·05 cubic foot of gas per hour. The critic, in his attempt to make out a good case for electricity, assigns an efficiency to metallic filament lamps of 1·2 watt-hours per candle. A large batch of results of photometrical testings before us give a number of lamps of present well-known makes an average efficiency of nearer 1·5 watt-hours per candle. Recent correspondence in one of the electrical papers and evidence of other photometrists confirm the point that the efficiency claims of the manufacturers of metallic filament lamps are not realized either in the photometer room or in ordinary use. There we have two defects in the basis of Mr. Wordingham's calculations. There are others. He takes gas at 3s. 6d. per 1000 cubic feet. Why, we do not know, save that he asserts that, on his erroneous efficiency figures, 3s. 6d. per 1000 cubic feet is equal to electricity at 3d. per unit. As very few electricity undertakings are selling current to ordinary consumers for lighting purposes at 3d. per unit, and as a comparatively small proportion of the gas used in this country is sold at 3s. 6d., we cannot see how these figures help Mr. Wordingham's argument. We are sorry to have to contradict his statement that the figures were "deliberately chosen as "being favourable to gas." Before us, there is a list of only 26 gas undertakings that are selling nearly half of the total gas supplied by statutory gas undertakings (excluding those without Acts of Parliament) in England at prices ranging from 2s. 6d. per 1000 cubic feet downwards; and if Mr. Wordingham "deliberately" sets himself to investigate the returns of the Board of Trade relating to both company and municipal gas undertakings, he will be astonished to find how many other gas undertakings are selling at 2s. 6d. and under, and how small a proportion of the gas supplied in this country is sold at anything like 3s. 6d. Can he say as much for electricity for domestic lighting purposes at 3d. per unit? Suppose we allow him a duty of 1·2 watt-hours per candle for metallic filament lamps, this is equal per unit to 832 candles. Taking the efficiency of a domestic low-pressure inverted gas-burner at 0·05 cubic foot per hour per candle, we have to consume 41·6 cubic feet to realize 832 candles; and, at 2s. 6d. per 1000 cubic feet, this is equal to 1·25d. This is the figure at which electricity must be sold per unit for domestic lighting to reach equality. The "switch habit" can now be cultivated in connection with gas supply; but, owing to this cheapness of gas lighting, people seem indifferent to it.

We must only touch lightly on the other parts of Mr. Wordingham's preliminary statement; and let us first make the point that, in the great majority of cases, the heating and cooking branches of the business of gas undertakings have been developed with gas at lighting prices, and not with gas at from 200 to 400 per cent. less than lighting rates, as in the case of electricity supply. That tells a significant tale. Our contributor speaks well of electric radiators, but gives the palm to gas for efficient and rapid heating, and concedes that cost is overwhelmingly in its favour, in comparison with electricity. Radiant heat is the most healthful form of warming rooms, and not convected heat. Only 30 to 35 per cent. of the electrical energy supplied to the electric radiator is given off as radiant heat, and the balance as convected heat; while 50 per cent. and upwards of the heat units supplied to a modern gas-fire are given off as radiant heat, some 25 per cent. as convected heat, and the balance is flue heat, which assists in ventilating the room. From these figures, Mr. Wordingham will be able to judge which is the more useful and healthful form of heating—the electric radiator, or the popular modern gas-fire; and he will also be able to calculate the relation to cost of the radiant heat by the two competing forms of heating. There is one point in this connection which our contributor might reconsider by the application of his knowledge of physics. He says that, with the electric radiator, "the natural venti-"lation of the room is not blocked, as happens when a gas-"fire is *so connected*, and is unlit." Supposing a gas-fire is fitted with a back blocking-up the sides of the ordinary fire opening, it has still its flue opening at the back, and to that flue opening is attached a length of flue-pipe of smaller diameter than the chimney. What is the effect of the length of small diameter flue-pipe, when the fire is unlit, in stimulating an upward current in the chimney? However, in the immense field in heating that exists for gas, Mr. Wordingham sees no occasion for qualms as to the future of gas. For that one considerate piece of encouragement, many thanks.

There has been such a considerable discussion in our pages of the other points raised in the article, and this article has already extended to such length, that we may leave our contributor's points for the present; but, if he desires it, we will take up the portions of his contribution not dealt with here in a further article when he has disposed of this criticism of his predicatory submissions in the first part of his own article.

A Geyser Fatality.

THERE has been for some time now immunity from serious accidents with gas-heated geysers, though, owing to their popularity, the connections made have been on a large ascending scale. The reason for the long immunity from trouble has been that gas-supply authorities have made it known that geysers for bath-water heating are as safe as any other system of heating, provided that the simple precaution is taken of fitting them each with a ventilating-flue; and no gas authority or responsible gas-fitter would now, under any circumstances, connect one without such a flue. We have to-day to regret what is truly termed a tragedy in South London; and a tragedy that would never have occurred if only common sense had been applied to the fitting of a geyser. Three young children (only eight, seven, and three years of age) have been asphyxiated, and two other children have had narrow escapes, in a box-like bath-room measuring only 7 ft. by 6 ft. 6 in. by 8 ft. high, or 364 cubic feet capacity. The domestic side of the occurrence is one which we will avoid, beyond saying there are certain aspects of the matter which will strike most parents. Our business is with the geyser; and it is hardly necessary to say that the South Metropolitan Gas Company were not in any way responsible for the fixing of the appliance, nor, in fact, had they any notion that there was a geyser in the house. There seems in this instance to have been an abuse of every elementary rule that the Company and all reputable makers of these appliances insist upon in connection with their fitting up. The geyser was privately

purchased by the father of the children, and fixed by a man who either did not realize any particular responsibility in the matter, or was not qualified to instal such an appliance. No ventilating-flue was attached to the geyser; five children were in the bath-room with its capacity of only 364 cubic feet; the window of the room was closed, and the door was shut by the children; the small unventilated geyser (which was of an old-fashioned and not most commonly used type) had a defective burner, capable of consuming no less than 96 cubic feet of gas per hour. The whole circumstances are extraordinary. The Gas Company have fully investigated the conditions connected with the terrible happening; and they are conditions which ought never to have been in existence, and would not have been had the Company had anything to do with the work of fixing the geyser. So far as we are aware, there has never been an accident with a geyser with a ventilating-flue attached. It is the abuse of elementary rules and principles by outsiders that brings disrepute upon a useful, economical, rapid-working, and (if simple rules are observed) safe class of appliance.

Dispensing with High-Pressure Lamp Globes.

With the large units of high-pressure lamps, one of the difficulties and chief costs in maintenance are the globes. They are large to transport and handle, large to clean, and, when there is fracture of a mantle and flame escapes bounds, disaster threatens the globe. The large globes, too, make the lamps look somewhat heavy for shop front work, though the other advantages of the lighting completely annihilate the one disadvantage. But if the disadvantage can be minimized, and at the same time the globe troubles be practically eliminated, so much the better. An article elsewhere shows that the Keith and Blackman Company claim to have accomplished both these ends—through, primarily, the adoption of small silica cups by which the mantles are enveloped, instead of large globes; and, secondly, by certain improvements in interior design. We have seen lamps with the silica cups in use, and are pleased with both their appearance and efficiency. Proof, there is confidence in saying, will soon be forthcoming (when the manufacturing arrangements allow the lamps to be freely placed on the market) that the Company have scored another success, which will largely assist the gas industry in the competition with high-power electric flame arc lamps.

One Disadvantage, and Good Compensation.

While appreciating for displacing glass, the advantages of a material capable of resisting intense heats such as are developed in high-pressure work, the objection that will, on first blush, be raised to the employment of silica is that it must absorb a proportion of light. By improvements in production, this absorption has been reduced; but such as it now is, it is more than counterbalanced by the improved efficiency that it enables the lamp itself to give. The silica cup in the new Keith lamp does not allow the passage of any secondary air to the flame; all the air that is required is taken in as primary air. In the form of lamp to which we have become accustomed, the secondary air was an advantage, in that it assisted to maintain a lower globe temperature. But there is now no globe to keep cool. Thus there is no reason for the retention of the secondary air supply; but there is much reason to the contrary. The flame temperature is increased, or rather is not depreciated by the secondary air; and in contrast with the old form of lamp construction and glass globe, there is a gain in efficiency sufficient not only to compensate for absorption of light by the silica cup, but to give an increase in the actual useful efficiency of the lamp. The details of the new advance will be found in a special article elsewhere. Among the gains effected by it are the distinct reduction in maintenance cost that must ensue from the use of silica cups in place of large glass globes; the knowledge that the destruction of a mantle will not put the lamp completely out of service as a light-giver (seeing that the cup will hold the mantle within range of the flame); a continuously clean reflecting surface is maintained; the illuminating power is increased; the general appearance of the lamp is improved and reduced in size; and withal the cost of the lamp if not diminished will not be increased. We are inclined to think that among gas undertakings the new Keith lamp will be even more popular than the old types. We shall see what working experience will bring forth when the lamps are ready for general sale.

A Mutual Coal Arrangement.

The South Suburban Gas Company, as enlarged by the absorption of the Bromley and Crays and West Kent Gas Companies, met last Friday; and, under the combined circumstances of the union and of the times, there was ample material for the Chairman (Mr. Charles Hunt) and others at the meeting to dwell upon. Among his other points, the Chairman made a suggestion which he prefaced with a statement with which we can all agree—"that extreme prices one way or the other can hardly be to the permanent advantage of the coal owners or to their most regular customers, who are the gas undertakings." It must be at least as unpleasant to a coal owner to have his pits standing more or less idle in times of bad trade as it is embarrassing to a gas undertaking to be obliged to raise the price of gas. Well, now, Mr. Hunt thinks it ought to be possible to avoid both—the one and the other—by a mutual arrangement in which the miners might participate. That is an interesting suggestion; more interesting still would be a concrete plan for carrying out the idea; and of still greater interest would be the manner in which the plan would work when evolved and put into operation. The miners do not trust the owners, nor the owners the miners; and we rather fancy that, under such a mutual arrangement, there would be something of the same feeling between the coal owners and the managements of gas undertakings. Before the coal strike, there was in many places a shortage of delivery under contract schedules; and if the mutual arrangement were established, and there came times of large demand and high prices, we picture coal that should find its way into the stores of gas undertakings arriving at other destinations. It might not be so; but the governmental control of which Sir Corbet Woodall and Mr. Charles Carpenter have lately spoken seems to hold the probability of greater effect than a mutual arrangement, which we feel convinced the coal owners would only be prepared to entertain when market values were low, but would not at all care about it when a contrary condition prevailed. The re-imposition of a tax on export coal is favoured as part of a system of control by not a few, and among them by political supporters of the Government.

Good News for Big Consumers at Sheffield.

It is not only the shareholders who will be pleased with the report for the past year of the Directors of the Sheffield United Gaslight Company. As compared with the preceding twelve months, the sales of gas show on the present occasion an increase of 6·13 per cent. The expansion, it appears, has been due to all classes of consumers; and an additional output for the year of 244 million cubic feet is a gratifying achievement. The Directors, however, are not content to rest here. They realize that there is still further scope for the consumption of gas in industrial operations; and, to quote their own words, with a view to further encourage the use of gas for manufacturing purposes, and also to assist the movement for the abatement of smoke, they have decided to make a reduction of 1d. per 1000 cubic feet where the consumption exceeds 500,000 cubic feet per annum, and also for gas-engines and the public lamps. This will make the Company's charges 1s. 3d., 1s., and 10d. per 1000 cubic feet. The big consumers are to be congratulated on the reduction now announced; but it must not be forgotten that the whole of the Company's consumers are in an exceedingly fortunate position—the average price at which gas was supplied during the past twelve months being no more than 1s. 1·83d. per 1000 cubic feet.

An Alternative to Compulsory Arbitration.

As the result of an extensive investigation in Canada, Sir George Askwith, Chief Industrial Commissioner to the Board of Trade, has issued a report dealing with the operation there of what is known as the Lemieux Act, the object of which is to ensure the recognition of the interests of the public, as a third party, in trade disputes, and the insistence that this third party, through the Government, shall have a voice in regard to a dispute affecting their interests before a stoppage of work takes place. The Act requires that any dispute arising in connection with those industries whose uninterrupted continuance is of high importance to the well-being of the nation shall be submitted to a board of conciliation and investigation, with a view to arriving at a settlement before a strike or lock-out can be legally brought about. Another provision stipulates that at least thirty days' notice shall

be given of an intended change affecting conditions of employment with respect to wages or hours, and that pending the proceedings before the Board, in the event of such intended change resulting in a dispute, the relations to each other of the parties to the dispute shall remain unchanged, and neither party shall do anything in the nature of a lock-out or strike. This is, of course, altogether different from what is understood by compulsory arbitration, as it merely endeavours to postpone a stoppage of work in certain industries for a brief period and for a specific purpose. It is pointed out that it does not destroy the right of employers or workpeople to terminate contracts, and does not prohibit a stoppage, either by lock-out or strike, if it is found that no recommendation can be made which is acceptable to both sides. The Act appears to be well liked in Canada; and Sir George Askwith expresses the opinion that the forwarding of the spirit and intent of conciliation is its more valuable feature. He thinks that in the United Kingdom it might be feasible and advantageous to pass an Act to give opportunity for such investigation and recommendation as would bring to light the real causes of difficulties—even though the restrictive features of the Canadian Act, which aim at delaying stoppage until after inquiry, were omitted.

Profits and Losses.

It appears from a White Paper issued some days ago that for the year to March, 1912, the total amount transferred in aid of rates from the accounts of gas supply and electricity undertakings, harbours, docks, piers, canals, and quays, tramways, light railways, and water-works, in the hands of local authorities, was £1,516,000; while the total sum transferred from the rates to meet deficiencies in the accounts of such undertakings was £932,000. Compared with the previous year, this is an increase of about £200,000 in the profits transferred, and a decrease of some £40,000 in the deficiencies to be made good. The amounts contributed in aid of the rates are given as follows: Gas supply undertakings, £612,000; electricity concerns, £230,000; water-works, £202,000. On the other hand, the sums transferred to meet deficiencies amounted to a total of only £14,000 in the case of gas undertakings; while electricity works are responsible for £60,000, and water-works for £543,000. It would seem that there is ample solid ground for the argument that ratepayers as such do not incur any very great amount of risk from the running of a municipally owned gas undertaking.

Electric Wiring and Fittings Dealings.

There has been a compromise between the Sheffield Corporation and the electrical traders, by which the House of Lords has seen its way to avoid open conflict with the House of Commons over a private municipal measure, surrounding which there were special circumstances. The compromise enabled the Upper House to consent without entirely renouncing the principle it has laid down in connection with this matter of municipal trading in electric wiring and fittings; but the discussion in the House has shown those who are hoping to get wide powers of trading in electric wiring and fittings that the Lords are as obdurate as they ever were. The Sheffield Corporation were evidently made aware of this after the House of Commons returned the Sheffield Bill to the Lords, disapproving of their amendments. The destruction of the Bill was within sight, if a way for a peaceful settlement could not be found. The Corporation and the traders therefore agreed that the Corporation should be allowed to do business in wiring and fittings up to the outlet from ceilings, walls, and floors; but work and fittings sales after these points are only to be through contractors who are in business independent of the Corporation. The Lord Chairman of Committees (the Earl of Donoughmore) and other members of the House made it clear that it was not to be taken, in concurring in the compromise, that there was any weakening on the part of the House in the attitude it has taken up of late years. This does not look healthy for the Bill of the Municipal Electrical Association, which has been occasionally brought off the shelf for a little airing, and has then been put back again. The Bill ignores the contractors, and does not therefore conform with the existing model clauses referring to wiring and fittings. Perhaps the Association will reconsider the matter in the light of the Lord Chairman's pronouncement, and not expend a considerable sum of money on what will be a severely opposed measure, with the certainty of amendment by the Upper House.

Gas Companies as an Investment.

Irrespective of changing sentiment, there are always people who appreciate the advantages of gas companies' stocks and shares from an investment point of view; and now that the recent fashion of placing capital in any and every part of the world rather than in our own country is showing decided signs of weakening, gas stocks may reasonably look for a fair share of the benefit which should accrue from the increasing favour of home undertakings in the eyes of investors generally. The prosperity of the industry is recognized by a writer in the "Investors' Chronicle," who points out that gas companies are reporting, for a period of dear coal and other difficulties, results that are eminently creditable, "and that emphasize the good management with which this much-threatened, but still most vigorous, British industry has been favoured, especially of late years." Attention is drawn to the noteworthy fact that, with coal costing substantially more, several companies have been able to reduce the price of gas and increase their dividend. On the other hand, it is admitted that in hardly a single instance has a decline in dividends been seen; while "many companies who are restricted by Statute to a maximum distribution are in a better position than for some years." Much of the credit for the prosperous condition of affairs now so widely witnessed is given to the development of the heating and cooking side of the business, and of the prepayment meter branch of the lighting department. In addition, however, to these lines of activity, the author of the article in question thinks the satisfactory results shown may to some extent also be placed to the credit of co-partnership; for, he says, "in no other industry has this principle been more generally or generously adopted." The remark might fairly have been "as generally."

Automatic Street Lighting at Tottenham.

The advantages of being able to light and extinguish street-lamps at any time by means of pressure-waves from the gas distribution centre was well illustrated in the district of the Tottenham and Edmonton Gas Company last Saturday. On the morning of that day, the fog which had been prevalent all the week shifted somewhat, but increased in density to such an extent that there was almost total darkness over that part of Greater London. The Engineer of the Company (Mr. A. E. Broadberry), after consultation with the District Surveyors by telephone, decided to light the street-lamps, and within a very short time the pressure regulation had been effected, and the whole of the lamps (nearly 5000) were alight. The darkness continued till one o'clock p.m.; and then as daylight reappeared, further regulation of pressure extinguished the lamps. There were very few failures, and considerable satisfaction was felt by the shopkeepers and residents at the prompt lighting of the area. This is the second time within a few weeks that the street-lamps have been thus lighted during the daytime on account of fog. The experience also serves to show the advantage of having lighting and extinguishing apparatus controlled by pressure-waves rather than by clockwork only, with which, of course, the prompt action above described could not have been effected. By the way, the Tottenham Company's output of gas on the day referred to exceeded their previous record of Christmas Eve.

Mr. J. W. Randell, the Engineer of the Fulham station of the Gaslight and Coke Company, whose death was recorded in the "JOURNAL" for the 7th ult., left estate of the gross value of £11,432.

The Midland Junior Gas Association will next Saturday afternoon pay a visit to the works of the Wolverhampton Gas Company, where they will be received by Mr. P. G. Winstanley, the Engineer and Manager.

It is announced that Dr. Frank Clowes, F.I.C., the Chemist and Superintending Gas Examiner of the London County Council, is about to retire under the age limit. Dr. Clowes has held this appointment since 1897, when he succeeded Mr. W. J. Dibdin. Previously, from 1881, he had been Professor of Chemistry at the University of Nottingham.

We learn from the "Journal für Gasbeleuchtung" that, encouraged by the success of their exhibitions held at Cologne and Breslau in the years 1911 and 1912 respectively, the Association of German Gas and Water Works Officials propose to hold another this year. The exhibition is planned for the late summer, is to take place at Frankfort-on-Main, and is to be on a larger scale than the previous ones, lasting a fortnight.

We have received from Messrs. J. S. Withers and Spooner, of 323, High Holborn, W.C., the sixth edition (1913) of their "Guide to Patents, Trade Marks, and Designs." The object of the book is to explain to inventors the elementary steps necessary in connection with the protection of inventions and the registration of trade marks and designs. It does not profess to be exhaustive, but deals with points upon which the authors find inventors most frequently require information.

OBITUARY.

The death is announced, at the age of sixty-seven, of Dr. GUSTAF DE LAVAL, of Stockholm, whose name is best known in this country in connection with his turbine. His inventions, however, covered a wide field, as testified by the patents taken out by him.

In the last number of the "JOURNAL," the death was briefly announced of Mr. JOHN ASHTON COOMBS, of Cheltenham. Deceased was born in 1848, and was educated at High Cross College and at King's College, London. He was articled in 1864 to the Engineer and Manager of the Nine Elms Gas-Works (then in the hands of the London Company, but subsequently in those of the Gaslight and Coke Company) and after eleven years' service removed to Cheltenham to take the position of Chief Assistant and Resident Manager of the Gas Company. He was a man of studious habits, and was for many years a member of the Geologists Association and a Fellow of the Geological Society. He leaves a widow, one daughter, and three sons, the youngest of whom follows his father's profession.

The death has occurred under sad circumstances of Mr. LEONARD RODWELL WILKINSON, who was known and respected by many people connected with the gas industry, through his being on the Boards of the Imperial Continental Gas Association and the British Gaslight Company. He was the eldest son of the late Colonel Josiah Wilkinson, and took the place of his father, at the end of 1903, as a Director of the last-named Company. Deceased was elected a member of the Board of the Imperial Continental Gas Association (of which his father was also a former Director) in November, 1905, in succession to Mr. Clarence Pigou. His training at the Bar, and his previous experience on the Board of the British Gaslight Company, materially assisted in making him an efficient Director from the very first. He was a man of great energy, and on many occasions rendered the Association considerable service abroad. His reports were always distinguished by their lucidity and acumen; and the Association have lost in him a very valuable Director, and the other members of the Board an amiable and clever colleague. Mr. Wilkinson was in his 44th year. He attended the Board meeting of the Association on the 15th ult., after an absence of some weeks on account of an illness from which he had evidently not fully recovered. The funeral, which took place at Lyndhurst (Hants.) Cemetery, was largely attended.

THE INSTITUTION OF GAS ENGINEERS.

Meeting of the Council.

A MEETING of the Council of the Institution of Gas Engineers was held at the offices, No. 39, Victoria Street, Westminster, on Tuesday last—the President, Sir CORBET WOODALL, D.Sc., in the chair. The following account of the proceedings has been communicated by the Secretary—Mr. Walter T. Dunn.

At the opening of the meeting, a resolution tendering the cordial congratulations of the Institution to the President on the honour of knighthood which had recently been conferred upon him by H.M. the King was heartily adopted.

A number of applications for admission to the Institution were considered, and names were approved for inserting in the next ballot list to be issued to the members in due course.

It was announced that the Senate of Leeds University, on the recommendation of the Board of Faculties of Science and Technology, had awarded the Institution Research Fellowship to Mr. Harold Hollings, B.Sc., who completed the prescribed course of study in the Department of Coal Gas and Fuel Industries for the B.Sc. degree in Fuel and Metallurgy, and was admitted to that degree last June.

With reference to the International Commission on Photometry, a statement was presented showing that the Sub-Committee, consisting of representatives of the National Physical Laboratories of the several countries interested, was engaged on the preparation of a new constitution, on broader lines than the existing one. It had been arranged that their proposals should be submitted for consideration to the various Institutions sending delegates to the Commission, and decisions taken at a meeting of the Commission to be held probably in September. The Council appointed a Committee to deal with this matter on behalf of the Institution.

The report of Dr. R. Lessing as the Institution's representative at the Eighth International Congress of Applied Chemistry held at Washington was read, and a vote of thanks to him for his services in that capacity was passed.

In regard to the question of the education and certification of gas-fitters, at the desire of the Midland Association of Gas Engineers and Managers, it was resolved that Mr. J. Ferguson Bell be requested to join the Institution Committee having this in hand. The Committee reported on the interview with Sir Philip Magnus which had taken place, and submitted proposals arising from it. These were generally approved by the Council; the drafting of the details and other necessary steps being left to the Committee.

A letter was read from Messrs. W. & T. Avery offering to present to the Institution the old Murdoch gasholder standing in their works at Smethwick. Some other Murdoch relics were also referred to; and it was decided an effort should be made to preserve them. Arrangements were made with this object in view.

The awarding of the Birmingham Medal was considered. The proposal that the President should be nominated for this distinction was heartily received; and instructions were given for the members to be notified in accordance with the regulations governing the award.

The Finance Committee presented their report, including the accounts for the year ended the 31st of December last, which were accepted and adopted.

Arrangements for the Jubilee meeting of the Institution, which was definitely fixed for June 17 to 20, were further discussed, and several offers of papers for reading were reported. It was decided that a dinner should be held on Wednesday, the 18th of June. An invitation from the President to a garden party at Chislehurst on the Friday was cordially accepted.

Progress in the work of organization of the National Gas Exhibition was reported—indicating that all the arrangements for a highly successful exhibition, on quite novel and attractive lines, were well in hand.

It was resolved that the Institution should extend its patronage to the National Health Exhibition to be held in London from the 16th to the 31st of May next.

On the subject of Standardization of Street Lighting, a further report was presented. In connection with it the invitation for the Institution to take part in the discussion of a paper on "Street Lighting" to be read by Mr. A. P. Trotter before the Illuminating Engineering Society on the 15th of April next was accepted.

The desirability of the Institution arranging for the conduct of research work on matters relating to ventilation was considered; and it was agreed that the authorities of Leeds University should be approached on the subject.

ELECTRICITY SUPPLY MEMORANDA.

THE subject of factory and workshop lighting has had additional interest and importance conferred upon it by the appointment by the Home Office of the Lighting of Factories Committee. The methods of lighting offered by the gas industry should stand well in the findings, if the industry is properly represented before the Committee. There is one thing, in making reference to the general subject, that we should like to insist upon. It is that no gas concern should have in its area a factory or workshop in connection with the lighting of which there has not been a vigorous effort to get it converted to one of the modern available gas systems, with the lighting applied in a judicious manner. We know the influence of municipal bodies with electric current for sale in obtaining the lighting of public establishments—such as schools, workhouses, and so forth—without the modern means of gas lighting being allowed to compete. But factories and workshops occupy different and independent ground; and the lighting of them should not be lost by pursuing a *laissez faire* policy. In every way, the gas industry has the best systems of lighting to offer for the purpose of illuminating such premises. These systems are economical; the intrinsic brilliancy of the light source is so much below that of electric lamps as to be a negligible quantity in comparison; the spectrum composition of the light is such that there is not found with it the harm to vision that such eminent eye specialists as Dr. W. Ettles find is being produced at an increasing rate by electric lamps; what also is of great importance to the factory owner is that the light is constant, and does not cause, through a sudden breakdown, a wasteful rupture in the continuity of work; there is a better diffusion of the light than with electricity; while it can, if desired, be concentrated equally as well by means of reflectors. The matters that the Lighting of Factories Committee will look into must include, if there is to be any substantial advantage from their labours, the questions of quality of light and the character of the light source. Though gas can supply the most economical and reliable light, the importance of these virtues is not greater than that of the side of the question of illumination that affects the vision of workers. But factory owners, although a moral responsibility rests upon them in this respect, have not as yet been educated up to a full appreciation of the truth of the matter. With such importance does Dr. Ettles clothe this consideration, that he suggests that coloured glass bulbs should be used for metallic filament lamps to neutralize the effects of the extreme violet end of the spectrum, and tone down the intrinsic brilliancy. Imperatively necessary though these things are, in realizing them there would be a loss of illuminating efficiency, and consequently increased cost in relation to the amount of illumination demanded. The electrical industry are not out of the wood in these matters; and the advantage that gas possesses in this connection must be pushed well home.

Workshop Lighting.

As the last two issues of the "JOURNAL" have shown, the subject of the illumination of engineering workshops by gas, electricity, and oil has been under discussion before the Manchester Association of Engineers. It is enough here to refer to gas and electricity. Mr. Franklin Thorp

Silica Chimneys—Cost Structures

dealt with gas, and Mr. Haydn Harrison with electricity. Mr. Harrison appears to have become a sort of special pleader for electric lighting in the area of the Manchester Corporation Electricity Department. The papers and discussion as affording a basis for comparison by practical men will, we think, entirely fail. In the gas paper there was much more that was practical than in the electrical one; and in the electrical paper there was much more that was theoretical and hypothetical than in the gas one. Even so, Mr. Thorp did not go to the extreme length of the points that it was open to him to make. As a preliminary to other makers, there was particular interest in what he had to say concerning the Newbigging-Thorp system for factory lighting. Naturally, manufacturers with the best quality of light they can obtain for their premises prefer that renewals shall be as light as possible, and that adjustment shall be easy; and where adjustment for a large installation of lamps is possible by a single screw at the compressor, there is something that will be recognized as a convenience. We see, too, that these lamps are fitted with silica chimneys in place of ordinary globes. There was the abstract of a patent specification in last week's issue [see *ante*, p. 408] referring to a somewhat similar proposal; and a more detailed article this week. We are convinced that more is going to be heard of a transfer from the large glass globe to a simple heat-resisting transparent substance fashioned as a protector for each high-pressure mantle. Mr. Thorp, in his paper, gave definite figures for the carrying out of an installation of high-pressure lighting of an aggregate considerable candle power; and he offered to show his *bona fides* by doing the work at the price. Mr. Harrison quoted capital costs for electricity, which he did not offer to materialize by installation. Challenged by Mr. Newbigging as to these capital figures, he said he knew of flame arc lamps quite good enough for workshop use that could be bought for £3 3s. Mr. Harrison will unquestionably oblige us by saying whether or not these lamps are of so-called 2500-candle power, whether or not their durability is equal to that of more expensive flame arc lamps, whether or not their efficiency is equal to those upon which he based his estimates, and where these lamps are to be purchased. Then we see that Mr. Thorp calculated his costs on gas at 2s., *plus* a charge for compression which he named; while Mr. Harrison only charged electricity at 1d. per unit. This planing-down of the electrical costs in order to make something of a comparison with gas may be regarded as quite a work of art; but the electrical arithmetical structures usually collapse in practice.

And Other Points.

The flame arc lamps, too, of which Mr. Harrison spoke as having an efficiency of 5 candles per watt are few and far between. It must have been a fortunate photometrical snapshot when Mr. Harrison realized such efficiency. This gentleman also speaks of tungsten lamps of 45-candle power (he knows how greatly tungsten lamps of the same nominal rating vary in their candle power) which thoughtfully throw 100-candle power into a photometer by reflection. It was a gossamer case that Mr. Harrison put forward; and the electrical people could have wished it had had a more solid appearance. Mr. Harrison, we further see, does not know of small 20-candle power inverted burners that are efficient when using a flame source. His knowledge is deficient. He is also somewhat afraid of the products of combustion of gas-flames in factories. It is singular how some people take alarm at the phantoms of their own imagination. We do not object to the products. They are much preferred to the carbon dioxide mixed with the organic matter of human respiration, which mixture has a greater specific gravity than the higher temperature carbon dioxide of the gas-flame mixed with its other product, water-vapour. We find reason for commiserating with Mr. Harrison upon the fluency he possesses for testifying to his ignorance on the subject of the following statement: "It should be unnecessary to cite examples to engineers who have no doubt learnt already the effect of gas on the working capacity of their employees." We would sooner trust such physiologists as Dr. Leonard Hill on this particular question than Mr. Haydn Harrison. Perhaps, however, Mr. Haydn Harrison would sooner trust Mr. Haydn Harrison. If so, he will perhaps in our columns cite examples which will be capable of investigation, and are supported by trustworthy authority, as to the working capacity of employees being depreciated where gas is used, and where the other factory conditions are such as will not of themselves produce a lowering of working efficiency. Mr. Harrison referred to gas being used for driving plants for electricity supply. Of course, it is unnecessary to remind him that there are many instances of private gas-driven plants furnishing current for lighting at a cost with which the local electricity suppliers cannot compete. As factory lighting, as a rule, goes to raise the peak of the lighting load, Mr. Harrison knows as well as we do that 1d. per unit is not a fair price, having regard to the charges to the other lighting consumers. But where a case has to be made, it is sometimes necessary not to be too particular about commercial principles.

The Grotesques.

With 6 to 12 per cent. (and more in cases) increases in gas consumption in the short space of six months, the managers of gas undertakings can afford to laugh loudly in the faces of those electrical prophets and fanatics who rejoice in making themselves look grotesque. Filtering down from Siemens and others, the idea reached Mr. Ferranti as to the carbonization of coal for power gas and the recovery of valuable secondary products, with the utilization of the gas for generating electricity. Mr. A. H. Seabrook was recently at a dinner of the West Ham electrical officials and their friends; and he subsequently stated, in the course of a speech, that "gas had a future, but certainly not in its present crude form for direct lighting and heating. The oft-told tale: Coal would be gasified, and the gas burned under boilers to produce steam for turbine turning; bye-products would be "reclaimed" [*sic*]. Bye-products are not the only things that require reclaiming. So it is seen that, in the view of the prophet of St. Marylebone, the place of the gas industry in the system of utility is to be wholly closed. Old Mother Shipton's prophecy as to the end of the world has from its birth been shifted to suit the times, in view of the failure of the world to considerately comply with the prediction. It is much the same with regard to the electrical prophecies as to the gas industry. Since the beginning of the 'Eighties, there has been electrical prediction as to the coming destruction of the gas industry. The gas industry, however, seems to be in no hurry over the matter; on the contrary, it waxes stronger year by year. But the electrical tongue, especially post-prandially, still wags over the approaching doom of the competitor. "Meteor" has now got affected—and badly. "The fact must be faced," he remarks, that "the crude direct use of a poisonous gas for domestic purposes is being more and more circumscribed every day." This is not a polite way of treating anything that is supposed to be in a dying condition—supposed, because figures have no value for "Meteor." However, he is not a bad sort occasionally. He does not desire to see the gas industry wiped off the face of the earth without giving gas men a chance. So he suggests a friendly conference between gas and electrical men over what he calls Mr. Ferranti's suggestions, but the authorship for which suggestions Mr. Ferranti will be prepared to admit could have been claimed when he was a very young person. "Meteor" also talks of a new type of gas-works arising under electrical auspices. Under the auspices of the gas industry, there has been lately quite a large transfer from arc lighting to high-pressure gas lighting; under the auspices of the gas industry, quite a large number of important private electricity generating plants are running to-day; under the auspices of the gas industry, electricity supply business is being taken in hand in view of the proved derivable economy compared with a separate concern for undertaking the work.

Inopportune Breakdowns.

Southampton is one of those places that are held up to admiration for progressive work in connection with electricity supply, and an attempt to develop cooking and heating business at ½d. per unit. But Southampton suffers from the ills that electricity concerns are heir to. There is no defining the limits of these ills. Fresh troubles and worries spring to life in all sorts of places, and deprive of a supply users of electricity for lighting, for heating, for (shall we write it out of politeness?) cooking, and other purposes. Just at the time the Southampton Electricity Department had published a new pamphlet showing that no other agent could excel electricity for any purpose to which it was applicable, there was a collapse of the supply; and the engineer and his staff had to hide their blushes behind the covers of their new pamphlet. The collapse happened in the worst month of all—December. It was due to flooding—the flood-waters were of the penetrating kind. They found their way into the basement of the generating-station; the cable ducts forming a convenient channel. The condensing pond got filled up; the water found its way under the engine-room floor; and the condensers got blocked twice. The occurrence was unkind in its untimeliness. There was Newport (Mon.), again. Soon after the peripatetic one from the Tricity outfit exploiters had finished his bacon-frying and jam-tart performance in the town, and had awkwardly backed-out of a challenge extended to him by the Gas Company, and the Electricity Committee had offered to supply electricity consumers with outfits at a purchase rent of about £3 a year for five years, by which time there would not be much outfit left, there came a collapse of the supply. Probably this has slightly interrupted the rush (if the rush has started) for electric cooker outfits on the terms named. The Yorkshire Electric Power Company acknowledge that these breakdowns of supply have a retarding effect upon business. At all events, only a partial interruption in their case last July had this unhappy result.

A Coppée Coke-Oven Installation for Cross Keys.

An order has been received by the Coppée Company (Great Britain), Limited, for the erection of an up-to-date coke-oven installation for the United National Collieries, Limited, Cardiff. The plant is to be put down at the Company's Risca Colliery, Cross Keys, near Newport (Mon.), and will comprise a washery on the well-known Coppée principle to classify and wash 2000 tons of coal per day, 45 Coppée waste-heat ovens, and bye-product plant for the recovery of tar, sulphate of ammonia, and benzol. A benzol rectifying plant is also included. The washery will be constructed on the latest lines, and will be built entirely of fire-proof material. From the coke-bench, the coke will be loaded into railway waggons by a Coppée patent coke screening and loading machine, which will be the first machine of the type to be put up in this country. The whole plant is being laid out so as to permit of considerable extension in the future.

WATER LEGISLATION FOR 1913.

[Second Article.]

In the last number of the "Journal," the Bills promoted by companies to obtain powers in connection with water supply were noticed. We now deal with the local authorities' measures containing provisions bearing on this branch of the public service.

The Aberystwyth Corporation require an extension of their limits of water supply so as to include certain parishes specified, and also authority to construct new works, comprising an aqueduct, conduit, or pipe-line commencing in the existing reservoir of the Corporation in the parish of Trefeirig, in the county of Cardigan, and terminating by a junction with the water-main near the old reservoir in the parish of Isa'ndre. Ten years are required to complete these works. It is provided that the Corporation are not to be compelled to furnish a supply of water for domestic purposes for any less sum than 12s. 8d. in any one year, nor to any dwelling-house, or part of one, of which the rateable value amounts to or exceeds £10 for any less period than six months. The Corporation wish to be empowered to supply water by measure, and to require it to be taken in this way in the case of farmhouses. They also propose to sell water in bulk. They ask for power, with the sanction of the Local Government Board, and after local inquiry by that Department, at any time to increase the water-rates leviable by them, by such amount as may be considered necessary to meet the estimated expenditure of the undertaking. [*Parliamentary Agents: Messrs. Baker and Sons.*]

By an agreement dated May 29, 1911, and confirmed by the Merthyr Tydfil Corporation Water Act, 1911, the Barry Urban District Council are authorized to take a supply of water in bulk from the Corporation, conditionally upon the Council obtaining parliamentary sanction to lay the mains and construct the works required to bring the water into their district. In accordance with the agreement, the Council have promoted a Bill to enable them to maintain the works sanctioned by Acts passed in 1886 and 1889, and to construct others, consisting of a service reservoir in the parish of Pentyrch, an aqueduct or pipe-line commencing in Merthyr Tydfil and terminating at the above-named reservoir, and another running from the reservoir to an existing main of the Council in the parish of Barry. Ten years are required for the completion of these works. It is proposed that the limits of supply of the Council shall be their district, the parishes of Sully, Wenvoe, and Porthkerry, and so much of the parish of St. Andrew's Major as lies to the western side of Dinas Powis Brook, and is not included within the water limits of the Corporation of Cardiff. The other provisions of the Bill relate to the sale of water by measure and in bulk, the deposit of security by consumers of water for other than domestic purposes, the fixing of the dates for the payment of water-rates, and the allowance of discounts for prompt payment. The Council desire to borrow £127,637 for the purchase of land and the construction of works; and they ask for sixty years from the time of borrowing in which to repay it. [*Parliamentary Agents: Messrs. Torr and Co.*]

In a General Powers Bill promoted by the Bradford Corporation, authority is sought for the construction of additional water-works, consisting of a reservoir on the River Nidd, in the rural district of Pateley Bridge, and two aqueducts or pipe-lines in connection therewith. It is proposed that the water limits of the Corporation shall comprise the city and the parishes and places specified in the Bill, one of which is Shipley; but it is provided that the Corporation are not to distribute water within that district without the consent of the Urban District Council. Permission is sought to borrow £750,000; and sixty years are required for its repayment. [*Parliamentary Agnets: Messrs. Dyson and Co.*]

The Corporation of Coventry are applying for authority to construct and maintain a service tank adjoining the southern of the two existing reservoirs at Coundon, for which power was granted in an Act passed in 1907; and they are asking for seven years within which to complete it. They are also asking for the confirmation of an agreement dated Aug. 29, 1912, made between them and the Birmingham Corporation, under which the latter will furnish Coventry with an additional supply of water in accordance with the terms and conditions set out in a schedule to the Bill. The period specified is from March 31, 1912, to March 31, 1967. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

A General Bill promoted by the Derby Corporation contains a few provisions in regard to water supply. It is proposed to increase the domestic rates specified in section 30 of the Derby Water-Works Act, 1848, to the extent of 4 per cent. per annum upon the annual value of the premises; and the Corporation wish for authority to make agreements with owners or occupiers within their limits who are not entitled to demand a supply, to extend their mains and supply the property on terms to be arranged. The other provisions enable the Corporation to lay pipes in streets not dedicated to the public use, repair communication-pipes, fix appliances for the prevention of waste, and require the testing and stamping by them of pipes, fittings, &c. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Ebbw Vale Urban District Council require authority to construct additional water-works, consisting of an intake weir on the Claisfer stream, in the rural district of Crickhowell, in Brecknockshire; an aqueduct or pipe-line (partly constructed) connecting it with the existing Carno filters of the Council; a second intake weir and aqueduct; and a compensation reservoir on the above-named stream. Ten years are asked for the completion of these works. The Council seek permission to borrow £120,500 in respect of the works specified, to be repaid within sixty years. [*Parliamentary Agents: Messrs. Martin and Co.*]

Further powers are required by the Epsom Urban District Council in respect of their water undertaking; and they are indicated in the second part of a General Bill. When water supplied for domestic purposes is used for washing horses, carriages or motor-cars, or other purposes in stables where these are kept, the Council wish to be authorized to charge, if a hose-pipe is used, such additional sum, not exceeding 20s. per annum, as they may prescribe; and they do not wish to be bound to supply otherwise than by measure any building used as a dweling-house of which any part is utilized by the occupier for any trade or manufacturing purpose for which water is required. The price for water supplied by measure is not to exceed 1s. 6d. per 1000 gallons. The other provisions of the Bill include one in respect of the creation of a reserve fund up to one-fifth of the aggregate capital expenditure on the water undertaking, which is to continue to be carried on by the Council under the powers of the Public Health Acts relating to water supply. The Council wish to be authorized to borrow, with the consent of the Local Government Board, such further money as may be necessary for the purposes of the Act. [*Parliamentary Agents: Messrs. Lees and Co.*]

In a General Bill promoted by the Huddersfield Corporation, confirmation is sought of an agreement entered into between them and the Deanhead Commissioners and others for the transfer of the Deanhead reservoir, and all property acquired and works executed by the Commissioners under their Acts of 1838, 1841, and 1889. On the day of transfer, these Acts will be repealed, except in so far as may be necessary for carrying into effect the winding-up and dissolution of the body acting under them. The Corporation require authority to construct a conduit or pipe-line from the outlet of the Deanhead reservoir to the existing reservoir of the Corporation in the parish of Lindley-cum-Quarmby. Provision is made for furnishing compensation water by the Corporation after the day of transfer. They ask power to borrow £12,580 for the purchase of the Commissioners' undertaking, £3370 for lands for filter-beds and the works authorized by the Act, and £17,800 for the construction of the works—all to be repaid within sixty years from the dates of borrowing. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Leeds Corporation are applying for an extension until Sept. 1, 1926, of the period specified in their Act of 1907 for the completion of the works thereby authorized, and of the period named in the Act for the completion of works authorized by the Act of 1901. They also seek to be empowered to construct two conduits, for the completion of which they ask seven years. They require £121,467 for the purchase of lands and easements, and they wish to be allowed sixty years for its repayment. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Authority will be sought by the Lymm Urban District Council to purchase the undertaking of the Lymm Water Company, and certain lands of the Lymm Estate Development Company, Limited, and to supply water within their district and in the neighbourhood. The terms and conditions are set out in a scheduled agreement. The Council seek power to maintain, repair, and extend the water-works after these have been transferred to them. The limits for the supply of water are the district of the Council and the parish of Warburton, in the rural district of Bucklow, in the county of Chester. It is proposed to ask for the repeal of so much of the North Cheshire Water Act, 1864, as includes the parish just named within the limits of the North Cheshire Water Company. The rates for the supply of water are to be 2d. per week where the rateable value of the dwelling-house or tenement supplied does not exceed £5 per annum; above this sum and less than £30 per annum, not more than 7 per cent.; and above £30, a rate not exceeding 6 per cent. All inns and hotels, whether public or private, the rateable value of which exceeds £5, are to be liable to a rate not exceeding 7½ per cent. of the rateable value, whether this exceeds £30 or not. For every closet beyond the first, the Council wish to charge 5s. per annum; for the first bath, 10s.; and for every subsequent one 5s.—all to be paid quarterly in advance, and to be recoverable in all respects with and as the water-rate. Where the supply is by measure, the price is to be 2s. per 1000 gallons. The Council wish to be authorized to purchase and supply water in bulk. The consideration for the sale of the properties of the Water and Estate Companies is to be £20,250, *plus* a sum equivalent to the amount properly standing to the credit of the profit and loss account of the first-named Company on Dec. 31, 1912, up to the date that is fixed for the completion of the sale; such profits to be calculated on the basis of those earned during the twelve months immediately preceding the first-named date. The Council seek permission to borrow this amount and the money necessary for defraying the costs and expenses incident to the transfer to them of the undertaking and properties (exclusive of the costs of the Act); £10,000 for the extension and improvement of the water undertaking; the sum required to pay for obtaining the Act; and any additional money needed, with the consent of the Local Government Board. For the repayment of the water-works purchase-money, fifty years are required; for the estate purchase-money, sixty years; for the extension of the water undertaking, forty years; and for meeting the cost of the Act, five years. [*Parliamentary Agents: Messrs. Butterworth and Co.*]

COMPARATIVE WORKING RESULTS OF THE LONDON AND FOUR SUBURBAN GAS COMPANIES.

IN THE HALF YEAR ENDED DECEMBER 31, 1912.

Compiled by Mr. F. J. BRADFIELD, the Secretary of the Commercial Gas Company.

——	Gaslight and Coke.	South Metropolitan.	Commercial.	Brentford.	Wandsworth.	South Suburban.	Tottenham.
Gas sold . . . . . thousands	13,600,359	6,529,978	1,715,635	1,613,384	608,656	994,628	932,375
Increase . . . . . per cent.	7·26	6·21	3·84	10·24	7·12	x 3·29	12·78
Gas made per ton of coal . . . . cubic feet	12,042	12,494	12,958	12,044	11,706	12,120	12,940
„ „ per gallon of oil . . . . „	446	..	420	390	393	408	460
Gas unaccounted for . . . . . per cent.	6·13	5·30	5·38	7·54	6·42	7·72	10·49
Coke made for sale per ton of coal . cwt.	9·91	9·23	10·89	10·88	10·81	9·81	9 12
Tar made per ton of coal . . . . galls.	9·54	9·73	10·42	10·45	10·02	9 89	..
Liquor made per ton of coal . . . galls, 8 oz.	36·12	40·85	38·23	34·21	30·83	38·94	37·47
Percentage of coke used as fuel	21·37	25·25	12·87	13·03	13·55	18·28	23·99
Capital expended per 1000 cubic feet sold during the past year	s. d. 10 11·29	s. d. 8 0·21	s. d. 8 7·02	s. d. 7 7·08	s. d. 6 7·72	s. d. †10 0·13	s. d. 7 8·76
Price charged per 1000 cubic feet	2/6 to 3/- 2/2	2 2	2 4	2 5	1 9	2/3 to 4/-	2 2
Costs per 1000 Cubic Feet of Gas Sold. REVENUE ACCOUNTS.	d.	d.	d.	d.	d.	d.	d.
Coals, oil, &c.	14·35	14·53	12·87	13·86	15·20	17·92	14·52
Less residuals—Coke and breeze	7·01	7·21	5·34	5·40	8·63	8·56	5·66
Tar	1·37	1·71	1·68	1·49	1·84	2·13	1·67
Amm. liq. and sulph. amm.	2·19	2·87	1·82	1·24	1·96	2·46	1·34
Total residuals . . .	10·57	11·79	8·84	8·13	12·43	13·15	8·67
Net for coals . . .	3·78	2·74	4·03	5·73	2·77	4·77	5·85
MANUFACTURE—							
Salaries	0·27	0·59	0·39	0·37	0·25	0·73	0 29
Wages—carbonizing	2·09	1·89	1·52	1·51	2·14	1·65	1·34
Purification	0·29	0·88	0·14	0·27	0·26	0·32	0·33
Repairs—plant	4·51	5·20	4·58	5·52	6·02	3·32	5·72
Net manufacture . .	10·94	11·30	10·66	13·40	11·44	10·79	13·53
DISTRIBUTION—							
Wages and salaries	1·05	0·78	0·73	1·19	1·11	1·22	0·98
Repairs—Mains and services, &c.	1·88	1·74	1·28	2·68	1·84	2·10	4·17
„ Meters and prep. meters and fittings	2·04	2·81	2·00	1·01	1·22	2·77	1·49
„ Stoves—ordinary and prepayment .	1·88	1·51	1·53	1·48	1·18	1·53	1·01
Total net manufacture and distribution .	17·79	18·14	16·20	19·76	16·79	18·41	21·18
Public lamps—lighting and repairing	0·51	0·64	0·39	0·59	0·56	0·89	0·63
Rents, rates, and taxes	2·98	2·03	2·19	1·91	0·90	1·49	1·88
MANAGEMENT—							
Directors, Auditors, and salaries (Secretary, &c.)	0·23	0·25	0·34	0·50	0·76	1·05	0·48
Collectors	0·47	0·60	0·69	0·55	0·43	0·56	0·50
Stationery and general charges	0·31	0·52	0·41	0·31	0·35	0·61	0·55
Profit-sharing	0·39	0·59	0·52	..	0·51	0·66	0·51
Bad debts	0·12	0·07	0·07	0·07	0·06	0·04	0·03
Law and parliamentary charges	0·02	0·06	0·04	0 02	0·46	0·39	0·04
Superannuations, &c.	0·49	0·49	0·36	0·39	0·17	0·46	0·08
National Insurance	0·07	0·10	0·06	0·06	0·08	..	0·08
Sundries	0·03	0·01	0·02	0 00	0·01	..	..
Total expenditure (*less* residuals) . . .	23·41	23·50	21·19	24·16	21·08	24·56	25·96
GAS	29·50	25·53	27·60	29·13	21·33	30·13	26·10
Rentals—Meters and prep. meters and fittings	2·91	3·09	2·90	3·32	3·52	2·23	1·93
Stove	1·14	1·26	1·58	0·90	1·19	1·52	3·74
Incand. mantle maintenance . . .	..	..	0·11	..	0·29	..	0·20
Miscellaneous	0·10	0·06	..	..	0·25	0·04	0·03
Total—Gas, rentals, &c.	33·65	29·94	32·19	33·35	26·58	33·92	32·00
Balance, being profit	10·24	6·44	11·00	9·19	5·50	9·36	6·04
Dividend and interest	10·61	7·60	8·95	7·16	6·00	8·68	5·40
Surplus	Def. 0·37	Def. 1·16	2·05	2·03	Def. 0·50	0·68	0·64
Contribution to funds	0·62*	..	..	..	..	..	0·26‡
SUNDRIES.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Coals cost per ton	14 7·62	14 1·68	14 7·20	14 8·17	13 10·79	16 11·98	15 9·93
Coke realized per ton of coal	7 4·97	6 10·47	7 9·21	7 6·83	8 9·73	8 3·80	7 4·72
Coke „ „ of coke	14 11·48	14 10·72	14 3·16	13 10·99	16 3·69	16 11·54	16 2·63
		Per Yard.				Per Yard.	Per Chal.
Breeze „ per ton	5 8·76	1 3·87	3 3·33	2 8·96	2 3·54	2 5·67	1 11·35
Tar realized per gallon	0 1·95	0 2·05	0 2·38	0 1·93	0 2·21	0 2·57	0 2·11
Amm. liquor, &c., realized per butt	7 4·88	7 4·55	7 9·13	5 6·64	7 1·81	6 9·48	5 2·15
Percentage of stoves at rental to consumers . .	72	93	64	91	91	80	51
Bad debts per cent. on total receipts.	0·27	0·17	0·17	0·18	0·15	0·09	0·07
Net profit per cent. on ordinary capital . . .	4·61	4·48	6·84	15·96	6·07	6·14	6·51
One penny variation equals in half year . . .	£56,668	£27,208	£7148	£6722	£2536	£4144	£3885
Carb. water gas, per cent. on total make . . .	17·68	..	33·31	35·35	13·59	7·45	29·47

* Special purposes and redemption funds. † Calculated on double half-year's consumption. ‡ Insurance fund.

x Increase on the 1911 consumption of the recently Amalgamated Companies.

We have received from Messrs. John Allan and Co. their "Analyses of Municipal Gas Accounts" for 1911-12. The accounts of 78 municipal gas authorities are analyzed, compared with 80 in the preceding issue; all items being worked out at per 1000 feet of gas sold. The makes range from 28 millions to upwards of 8454 millions per annum. To allow of easy comparison of one account with another, cardboard rules, either in blank to allow of figures being filled in, or with the figures of any particular undertaking in the series printed upon them, are, as before, supplied with the "Analyses." The price of the book is 10s. 6d. net.

COMPARATIVE WORKING RESULTS OF THE LONDON AND FOUR SUBURBAN GAS COMPANIES.

TABLE SHOWING THE VARIATION, INCREASE OR DECREASE, ON FIGURES OF CORRESPONDING HALF YEAR, 1911.

[The figures in heavy type show the decreases.]

Compiled by Mr. F. J. BRADFIELD, the Secretary of the Commercial Gas Company.

	Gaslight and Coke.	South Metropolitan.	Commercial.	Brentford.	Wandsworth.	South Suburban.	Tottenham.
Gas sold . . . . . thousands	1,081,582	382,043	63,436	149,935	40,480	*	105,671
Increase (variation equal to) . . . per cent.	8·22	8·66	5·11	8·02	5·51	*	8·48
Gas made per ton of coal . . . . cubic feet	199	102	136	**87**	**311**	**62**	159
,, ,, per gallon of oil . . . . ,,	**1**	..	**8**	29	39	..	79
,, unaccounted for . . . . . per cent.	·40	·62	**·62**	**·60**	1·40	·55	1·63
Coke made for sale per ton of coal . cwt.	**·11**	**·22**	·17	·04	·78	**·23**	·12
Tar made per ton of coal . . . . galls.	**·10**	·02	·36	..	**1·15**	·75	..
Liquor made per ton of coal . . . galls, 8 oz.	·92	1·24	·99	**3·73**	**·44**	1·37 Dec.	**·03**
Percentage of coke used as fuel	·44	1·71	**1·34**	**·42**	**6·16**	1·93	**1·01**
Capital expended per 1000 cubic feet sold during the past year	s. d. **0 4 87**	s. d. **0 4·14**	s. d. **0 2·63**	s. d. **0 5·79**	s. d. **0 1·35**	s. d. *	s. d. **0 7·75**
Price charged per 1000 cubic feet	**0 1·00**	..	..	..	..	**0 1·00**	**0 1·00**
Costs per 1000 Cubic Feet of Gas Sold							
REVENUE ACCOUNTS.	d.	d.	d.	d.	d.	d.	d.
Coals, oil, &c.	2·37	2·57	·44	**·09**	2·02	2·77	·82
Less residuals—Coke and breeze	·89	·57	·05	·68	1·44	·43	1·09
Tar	·08	·27	·24	·27	**·06**	·60	·37
Amm. liq. and sulph. amm .	·20	·22	·16	**·04**	·26	**·27**	**·01**
Total residuals . . .	1·17	1·06	·45	·91	1·64	·76	1·45
Net for coals . . .	1·20	1·51	**·01**	**1·00**	·38	2·01	**·63**
MANUFACTURE—							
Salaries	**·04**	**·02**	**·01**	**·04**	·03	·16	..
Wages—carbonizing	·05	·02	**·09**	**·08**	·03	·35	**·01**
Purification	**·07**	·04	**·03**	·03	**·01**	·07	**·02**
Repairs—plant	·55	·18	**·84**	**·10**	·43	**1·10**	**·01**
Net manufacture . .	1·69	1·73	**·98**	**1·19**	·86	1·49	**·67**
DISTRIBUTION—							
Wages and salaries.	**·02**	**·04**	·01	**·50**	**·05**	·03	·03
Repairs—Mains and services, &c. . . .	·17	·07	·30	**·17**	**·02**	·54	**·66**
,, Meters and prep. meters and fittings	·05	**·04**	·08	**·41**	**·10**	**·15**	·54
,, Stoves—ordinary and prepayment .	·18	·08	·07	·30	·07	**·15**	1·01
Total net manufacture and distribution .	2·07	1·80	**·52**	**1·97**	·76	1·76	·25
Public lamps—lighting and repairing	**·09**	**·05**	**·01**	·03	**·07**	**·13**	**·06**
Rents, rates, and taxes	**·27**	**·12**	**·11**	**·14**	**·13**	**·41**	·35
MANAGEMENT—							
Directors, Auditors, and salaries (Secretary, &c.)	**·04**	**·02**	·01	**·04**	·11	·31	·04
Collectors	**·03**	..	**·03**	**·05**	**·02**	·01	**·04**
Stationery and general charges	·04	**·09**	·08	..	**·02**	·03	·01
Profit-sharing	·04	**·03**	·01	..	..	..	·02
Bad debts	..	**·01**	**·01**	**·07**	·02	**·07**	**·02**
Law and parliamentary charges	**·02**	·03	..	**·14**	·25	·30	**·10**
Superannuations, &c.	**·03**	·19	·12	·07	**·01**	**·21**	**·01**
National Insurance	·07	·10	·06	·06	·08	..	·08
Sundries	**·10**	..	·01	**·01**	..	..	..
Total expenditure (*less* residuals) . . .	1·64	1·80	**·39**	**2·26**	·97	1·59	·52
GAS	**·84**	**·17**	**·03**	**·74**	**·07**	1·69	**1·12**
Rentals—Meter and prep. meter and fittings	·18	·05	·13	**·05**	**·06**	1·25	**·11**
Stove	·02	**·01**	·03	·02	..	·01	·23
Incand. mantle maintenance . . .	..	..	·01	..	·06	..	·02
Miscellaneous	·01	..	**·01**	**·01**	·04	..	·01
Total—Gas, rentals, &c.	**·63**	**·13**	·13	**·78**	**·03**	2·95	**·97**
Balance, being profit	**2·27**	**1·93**	·52	1·48	**1·00**	1·36	**1·49**
Dividend and interest	**·53**	**·52**	**·41**	**·41**	**·30**	1·58	**·54**
Surplus	**1·74**	**1·41**	·93	1·89	**·70**	**·22**	**·95**
Contributions to funds	**·22**	..	..	..	..	..	**·03**
SUNDRIES.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Coals cost per ton	2 4·32	2 6·23	1 2·41	..	1 3·88	2 10·64	0 10·66
Coke realized per ton of coal	0 7·30	0 6·33	0 3·37	0 11·10	0 9·39	0 11·69	1 1·78
Coke ,, ,, of coke	1 4·43	1 5·66	0 3·60	1 7·85	0 3·69	2 4·00	2 4·08
		Per Yard.				Per Yard.	Per Chal.
Breeze ,, per ton	0 8·13	0 3 84	0 9·91	0 3·02	**0 2·26**	**0 3·18**	0 8·43
Tar realized per gallon	0 0·03	0 0·32	0 0·27	0 0·35	0 0·05	0 0·70	0 0·24
Amm. liquor, &c., realized per butt . . .	0 1·22	0 3·65	0 8·99	0 4·41	0 4·87	0 0·40 Dec.	**0 2·85**
Percentage of stoves at rental to consumers . .	..	4	1	..	3	**6**	7
Bad debts per cent. on total receipts	..	**·02**	**·03**	**·16**	·04	**·16**	**·05**
Net profit per cent. on ordinary capital . . .	**1·01**	**1·19**	·67	4·11	**·88**	**·42**	**·89**
One penny variation equals in half year . . .	£4506	£1592	£264	£624	£169	£1132	£441
Carb. water gas per cent. on total make . . .	**5·42**	..	1·02	**·09**	**4·79**	7·45	**2·16**

* Not comparable, in consequence of recent amalgamation.

A meeting of the Yorkshire Junior Gas Association will be held in the Leeds Institute of Science next Saturday, when Mr. W. Walker Atley will deliver his Presidential Address. This will be followed by a paper on "Shop Lighting—High and Low Pressure," by Mr. W. Dawes, of Castleford. Subsequently, Mr. A. Edwards will briefly describe the Holophane Lumeter.

THE NEW KEITH LIGHT.

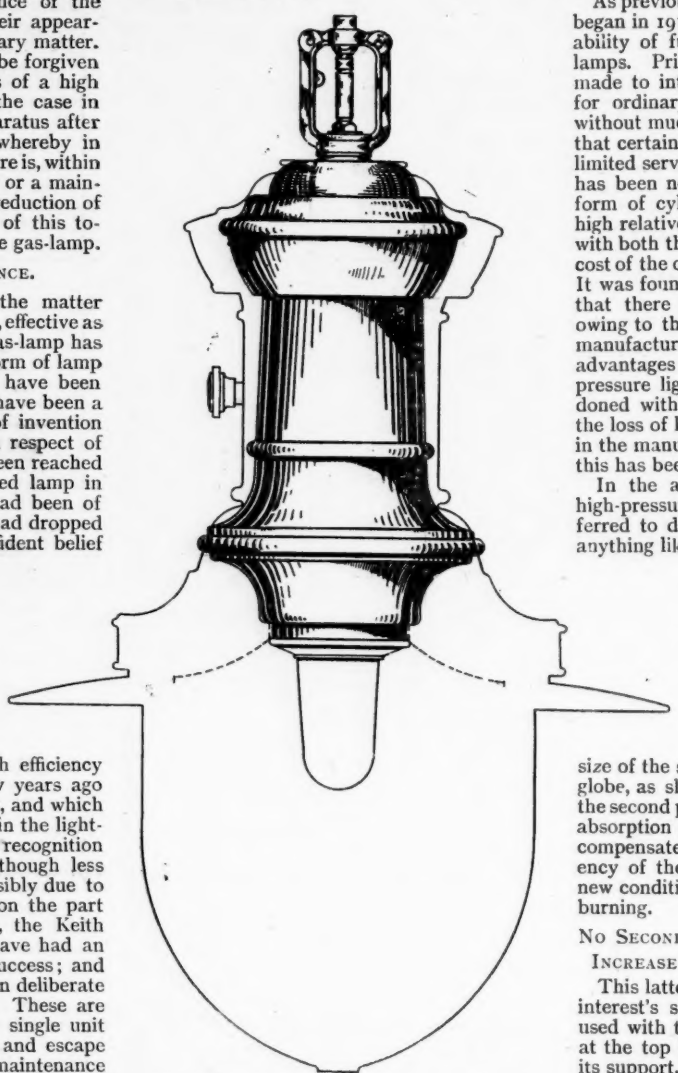
A Patented Lamp in which Glass Globes are Abolished, and Silica Cups for the Mantles are Used.

HIGH-PRESSURE lighting has attained a huge popularity, owing to the remarkable efficiency of the lamps, which efficiency has represented considerable economy, and has put gas lighting in a pre-eminent position in competition on a real commercial basis of costs. Lighting efficiency and economy are not the only recommendations that have contributed to the building-up of popularity to the present high stage. The value of the light in regard to its quality and diffusing and penetrating power, as well as steadiness, has received growing public recognition; these merits being of a character that are emphasized when brought into contrast with electrical competitors. The large popularity has been achieved with the lamps as we now know them. These lamps like electric flame arc lamps are not exactly things of beauty, though seeing the importance and excellence of the work that the former do, their appearance has been quite a secondary matter. Much in structural form can be forgiven when the service rendered is of a high order. It is nearly always the case in the invention of any new apparatus after changes are made in form whereby in some one or more respects there is, within limits, an improved efficiency or a maintenance of efficiency with a reduction of size. We have an example of this to-day in the Keith high-pressure gas-lamp.

THE LINES OF ADVANCE.

No one who has given the matter thought has ever believed that, effective as the high-pressure inverted gas-lamp has been in its results, the final form of lamp and final over-all efficiency have been realized hitherto. It would have been a notable thing in the world of invention if the maximum efficiency in respect of illumination or design had been reached by the high-pressure inverted lamp in one flight, and if inventors had been of that way of thinking, and had dropped all investigation, in the confident belief that there was not anything further to be gained in the way of development. The Keith and Blackman Company, Limited, favoured as they have been through the work of Mr. George Keith, have never considered that they had reached the impassable point with the series of high efficiency lamps which they but a few years ago presented to the gas industry, and which constituted an achievement in the lighting world which has had good recognition from the commercial side, though less from the personal side—possibly due to an innate retiring modesty on the part of the inventor. However, the Keith and Blackman Company have had an ambition to surpass their success; and so since 1910 there has been deliberate attack upon two problems. These are the design of a high-power single unit lamp of smaller dimensions, and escape from the difficulties and maintenance costs involved in the necessarily large globes that have to be used with the large units. The one problem has a bearing upon the other. If the big globes could be dispensed with, and a small cup used as a mantle enclosure, then, at one sweep, there would pass away a part of the lamp that gave to it, both by its length and girth, a bulky appearance. In the year named, the technical workers of the Company began to consider the possibilities—and soon appreciated that the possibilities existed within practicable reach—of the use of fused silica instead of glass for high-pressure lamps. There are several matters to speak of in connection with this use of a temperature-resisting substance in lieu of glass; but for the moment let us say that the Company have succeeded in producing a silica cup, of form and dimensions in relation to the mantles for the different sizes of their lamps, which will do away with large globes, and furnish a light that, with our eyes used to the old form of lamp and visible incandescent mantle, is novel and highly efficient as an illumination distributor. Concurrently, the interior of the lamp has been re-designed; but the time is not ripe for giving a detailed description of this, beyond the abstract of the patent specification that was published in our columns last week. Working on experience too, the more vulnerable parts of the lamps have all been strengthened.

The illustration accompanying this article shows a 1500-candle power new type lamp; and by means of a skeleton outline of the old type lamp of the same candle power, the relation in the matter of size is established of the new form to the old. The scale of the drawing is 2 inches to the foot. The part that looks like the mantle is the suspended cup surrounding the mantle; and this small adjunct to the lamp body constitutes "globe" and protector. It is an efficient, portable, and durable thing to handle; and the risks attaching to the transport and employment of a bulky glass globe are absent from it.



The New Keith 1500-Candle Power Gas Lamp—One-Sixth Scale.

THE USE OF FUSED SILICA.

As previously mentioned, the Company began in 1910 to investigate the serviceability of fused silica for high-pressure lamps. Prior to this, attempts had been made to introduce its use for cylinders for ordinary inverted gas-burners, but without much success, though we believe that certain gas authorities had them in limited service in 1907. However, there has been no general application of this form of cylinder, owing, chiefly, to its high relative cost—taken in comparison with both the power of the light and the cost of the ordinary clear-glass cylinders. It was found in these early applications that there was a definite loss of light, owing to the density of the material as manufactured at that period. But the advantages offered, in the case of high-pressure lighting, were not to be abandoned without an attempt to minimize the loss of light by certain improvements in the manufacture of the material; and this has been largely effected.

In the application of fused silica to high-pressure lighting, the difficulties referred to do not exist, or, at any rate, to anything like the same extent. Take the first point, as to the "high relative cost." This is discounted by the fact that a unit of light of very high candle power can be contained in a small silica cup—roughly about twice the size of the mantle. To appreciate this, one has only to look at the relative size of the silica cup and of the old glass globe, as shown in the drawing. As to the second point, any loss of light through absorption by the globe is more than compensated for by the increased efficiency of the lamp, owing mainly to the new conditions under which the flame is burning.

NO SECONDARY AIR NEEDED, AND AN INCREASE IN LIGHTING EFFICIENCY.

This latter point is worth pursuing for interest's sake. The silica cup that is used with the new Keith lamp has a lip at the top by which it is suspended for its support, and so entirely encloses the mantle. There is no aperture in the bottom of the cup. It has been found by the Company's technical investigators, as well as by others who have made independent research, that, contrary to all previously accepted theories, it is not necessary to admit secondary air in a well-designed high-pressure inverted gas-lamp—in which the mixture is highly preheated, and contains the requisite proportion of air for complete combustion—in order to obtain the maximum incandescence of the mantle. This being so, the admission of secondary air can only result in keeping down the temperature of the lamp generally—thus reducing the regenerative effect, and introducing numerous complications in the ventilation.

Of course, when ordinary glass globes are used, there is justification for introducing secondary air, to keep the temperature of the globes within practicable limits; but where silica cups are employed, this consideration does not apply. This then is where we have to look for the increased efficiency that more than counterbalances the amount of light absorbed by the silica cup. Briefly put, the total exclusion of the secondary air by the cup, and the confining of the flame to the limits of the cup, result in a higher flame temperature, in which the mantle is immersed. In other

words, there is not the large proportion of incombustible constituents of the secondary air extracting heat from the flame, and exerting a depreciating influence upon the incandescence of the mantles. The gain in flame temperature is a positive one; and the result is that *at least a 10 per cent. increase in efficiency is actually obtained after allowing for the absorption of light by the silica cup.*

Other Advantages of the Silica Cup.

This increase in illumination is not the only advantage. Claiming an equality of place in merit is the fact that the silica cups are quite unaffected by sudden variations of temperature. Although in use the globes are red hot, they may have cold water sprayed over them without suffering injury. For the same reason, the developing of a hole in the side of a mantle is quite immaterial, so far as the cup is concerned. Apart from the fact that the cup is unaffected by the fracture of the mantle, the light emitted on a mantle becoming fractured is not depreciated to anything like the same extent as when the usual large globe is employed, owing to the flame being confined within the radius of the cup. In other words, the area of the cup being only slightly larger than that of the mantle, the flame has (so to speak) a double line of resistance; and if it passes the first it cannot get beyond the second, so that the fractured mantle loses little of the active work of the flame. Even if a mantle dropped right away from its support, it would still be held up within the cup, so that, though the volume of light would be lessened, a reasonably good light would still be maintained by the flame playing on to the mantle wreckage. These points do not require accentuating to enforce their importance upon those with experience of high-pressure lighting; nor can it be necessary to say anything regarding the economy of maintenance that must accrue from the use of the silica cups.

What has been said does not exhaust the list of advantageous considerations. An important point which may not be at first apparent is that, through the use of the silica cup, an efficient reflecting surface can be brought quite close to the source of light without becoming discoloured. It is therefore possible to keep the reflecting portions and all the lower parts of the lamp which meet the eye in a clean and efficient state. In the new lamp, too, all the parts ordinarily exposed to the products of combustion are covered by the reflector, and the comparatively opalescent globe; and thus all unsightliness is overcome, and the efficiency of the reflecting portion of the lamp is fully maintained.

The New Lamp and Shop Lighting.

The foregoing considerations encourage the view that it is quite possible the adoption of the new lamp may lead to a revolution in the question of maintenance. What this will mean in connection with parade-lighting systems is fairly evident. The internal construction of the lamp, too, combined with the use of the silica cup, permits, as already shown, the use of a much smaller lamp casing for a given unit of light than in the existing types. For shop lighting, this will be an especial benefit, as not only will the smaller unit mean less obstruction to the shop window, but, there being no necessity for the usual reflector, a considerable amount of light will be available for illuminating the upper portion of the window and façia. The sketch of the form of lamp now in process of manufacture (and shortly to be placed on the market by the Company) shows a highly presentable thing for outside shop illumination; and, as we have said, the drawing gives a very good idea of the relative proportions of the new compared with the present form of lamp. This is the type of lamp that will be employed where an upward as well as a downward distribution of the light is required over a shop front; but provision is made for carrying any suitable form of reflector, as shown by the dotted lines in the illustration. A further structural point and useful change is that the air-regulator has been placed in such a position as to permit of it being adjusted from the ground by means of a suitable rod, which feature will be appreciated by those who are responsible for keeping such lamps up to their highest efficiency. Provision is also made for the protection of the mantle from wind, &c., during the process of cleaning or remantling.

Miscellaneous Points.

The Keith lamp in its new state represents a distinct departure and advance in gas lighting, and in the manufacture of gas-lamps. It will be appreciated that this result has only been arrived at by an elaborate series of experiments extending over a considerable period. There have been numerous minor difficulties not present with ordinary forms of gas-lamps which have had to be grappled with. But these, as previously stated, have now been successfully overcome; and we feel, from what has been seen, that the lamp is a marketable commodity, and will require less attention than the present form of high-pressure lamps.

One very gratifying feature which has consistently shown itself during the course of these experiments is that the globe is entirely unaffected by fog, dust, or rain. This, in itself, should greatly reduce the maintenance usually necessary to keep globes clean from the illumination-deteriorating effect of such atmospheric conditions.

Owing to the smallness of the silica cup, it will probably be found in practice more economical for the maintenance attendant to be equipped with a duplicate set of cups, so that the cups are only cleaned at the depôt, as the method of cleaning (although quite simple) differs from the ordinary. An idea of the size and portability of the cups will be obtained by saying that, in the case of the 1500-candle power lamp, the cup is about the size of an ordinary tumbler, and only 5 inches long. The cups are being made for the whole series of lamps, from the 60-candle power size upwards.

Multiple Lamps.

With regard to the large multiple burner lamps, the use of the silica cups offers very substantial advantages over the single large globe type at present employed. From experience, it appears that a practical limit has been reached as regards the size of units, with the old form of lamp, as well as that the large globes are more susceptible to sudden changes of temperature than the smaller ones. The method employed in the multiple-burner lamps is to use one silica cup for each burner, passing through a reflector with a corresponding number of holes. A very good example of this method is to be seen in two three-light lamps (which have been adapted to the new principle) in front of the Tottenham and Edmonton Gas Company's Offices in the High Street, Tottenham. The extraordinary difference in the effect must be seen to be appreciated. The diffusion of light is great; there is the optical illusion of mantles without any protection—the proximity of the silica cup to the mantle blotting out visually its existence, but the incandescent area appears to be larger. There are also to be seen around the Sir George Livesey statue at the Old Kent Road offices of the South Metropolitan Gas Company, single-burner lamps with silica cups, being adaptations of the existing pattern of lamps.

Working Pressure.

There is one note which should be made regarding the new lamp. It is that, from experiments, it would appear that in all probability it will be desirable with the new lamp to have a minimum pressure of 80 inches; and in some cases to go even beyond this, according to the quality of the gas.

In order to prevent disappointment on the part of those who may wish to make as early trial as possible of the new form of lamp, it should be mentioned that the arrangements for producing it are well in hand at the Keith and Blackman works, but there may be a little delay in placing it freely on the market.

Institution of Mechanical Engineers.

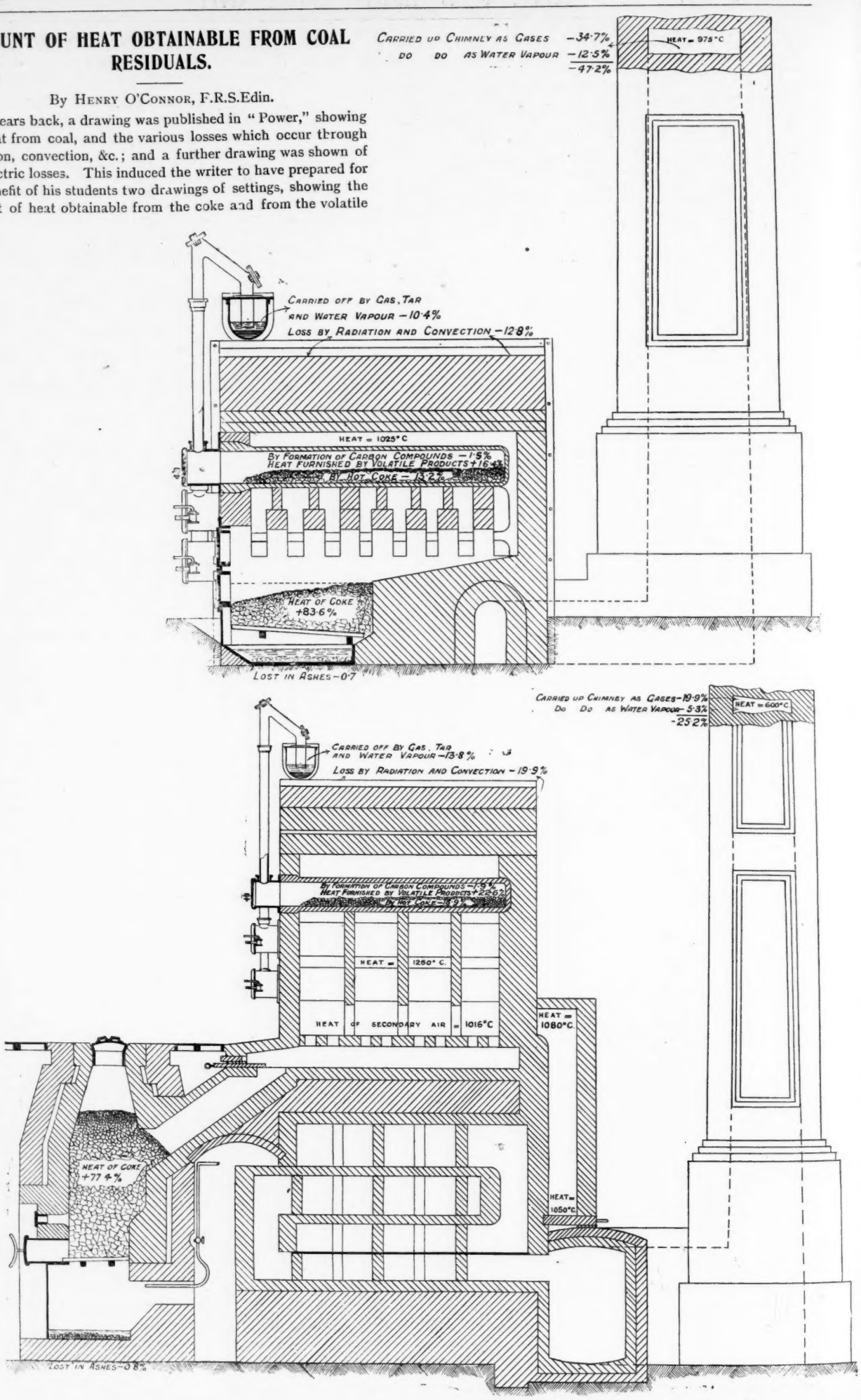
At the annual general meeting of the Institution last Friday, the Council presented their report for the past year. It showed that there were 710 additions to the roll of members; but as there were 378 deductions, the net increase in membership was 332—bringing up the total to 6160. The revenue for the year was £16,949; while the expenditure (less £400 reserved in the previous year for accounts since paid) was £13,343—leaving a balance of £2896, exclusive of entrance fees (£636) and life compositions (£74) carried direct to the capital account. The capital of the Institution amounts to £64,237. The Willans Premium, for the best paper published in the "Proceedings" from 1907 to 1912 inclusive, dealing with the utilization or transformation of energy, treated especially from the point of view of efficiency or economy, has been awarded to Professor Bertram Hopkinson, F.R.S., a member of the Institution, for his papers on "The Indicated Power and Mechanical Efficiency of the Gas-Engine" and "The Effect of Mixture Strength and Scavenging upon Thermal Efficiency," published in the "Proceedings" in 1907 and 1908. The third award of the Water Arbitration Prize was made to Mr. L. Zodel, for his paper on "High-Pressure Water-Power Works," which was read and discussed at the summer meeting of the Institution at Zurich in 1911. Unfortunately, Mr. Zodel died a few days after the award had been made. The fourth award (fixed for 1915) will be for the best original paper dealing with "New Investigations in Hydraulics," or "New Developments in the Distribution of Water for Town's Supply or Irrigation," or "Advances in the Utilization of Water Power." Papers should be sent in not later than Sept. 1, 1914. The prize is of the value of about £30. The Calcutta and District Section of the Institution continued their meetings during the session 1911-12; and among the visits paid was one to the works of the Oriental Gas Company. Sir H. F. Donaldson succeeds Mr. E. B. Ellington as President; and Sir John Wolfe Barry and Mr. Henry Davey were elected Vice-Presidents.

Midland Association of Gas Engineers and Managers.—The *agenda* for Thursday's annual general meeting of the Association (which will be held at the Grand Hotel, Birmingham, under the presidency of Mr. A. Cooke, of Oldbury) includes the receiving of a report from the Special Committee appointed to consider the advisability of forming a Commercial Section, and a presentation to the retiring Hon. Secretary (Mr. Harold E. Copp, of West Bromwich). The new President (Mr. W. S. Morland, of Gloucester) will deliver his Inaugural Address; and at the close of the meeting Mr. B. W. Smith will exhibit some interesting specimens of old methods of pipe-jointing found at Walsall. Afterwards, members will proceed, on the invitation of Messrs. Stewarts and Lloyds, to visit their Coombs Wood Works, Halesowen. The party will subsequently return to the Grand Hotel, where they will be the guests at tea of Messrs. Stewarts and Lloyds.

AMOUNT OF HEAT OBTAINABLE FROM COAL RESIDUALS.

By Henry O'Connor, F.R.S.Edin.

Some years back, a drawing was published in "Power," showing the heat from coal, and the various losses which occur through radiation, convection, &c.; and a further drawing was shown of the electric losses. This induced the writer to have prepared for the benefit of his students two drawings of settings, showing the amount of heat obtainable from the coke and from the volatile


Carried up Chimney as Gases -34·7%
Do Do as Water Vapour -12·5%
-47·2%
Heat = 975°C
Carried off by Gas, Tar and Water Vapour -10·4%
Loss by Radiation and Convection -12·8%
Heat = 1025°C
By Formation of Carbon Compounds -1·5%
Heat Furnished by Volatile Products +16·4%
By Hot Coke -13·2%
Heat of Coke +83·6%
Lost in Ashes -0·7
Carried up Chimney as Gases-19·9%
Do Do as Water Vapour- 5·3%
-25·2%
Heat = 600°C
Carried off by Gas, Tar and Water Vapour -13·8%
Loss by Radiation and Convection -19·9%
By Formation of Carbon Compounds -1·9%
Heat Furnished by Volatile Products +22·6%
By Hot Coke -18·7%
Heat = 1250° C.
Heat of Secondary Air = 1016°C
Heat = 1080°C.
Heat of Coke +77·4%
Heat = 1050°C.
Lost in Ashes -0·8%

products, as *plus* quantities making 100 per cent. in all, and indicating the various places where losses occur, owing to such causes as radiation, convection, &c., the withdrawal of the hot coke, chimney gases, &c. The figures used are those given by M. Euchêne in his valuable communication on the thermic reactions which occur during the distillation of coal, as given before the International Gas Congress in October, 1900, and published in the "JOURNAL" for Oct. 6 of that year. The communication is monumental, and only a very small portion of the information contained in that volume can be introduced pictorially. For a complete examination of the question, reference should be made to the number of the "JOURNAL" named.

As regards the points indicated on the drawing for the ordinary setting, the *plus* items, or those producing the heat, consist of—

Heat from coke	83·6 per cent.
Heat of the volatile products	16·4 ,, ,,

The *minus* items are the figures for the heat consumed, such as—

Carried up the chimney as gases	34·7 per cent.
Carried up the chimney as water vapour	12·5 ,, ,,
Removed by the hot coke	13·2 ,, ,,
Loss by radiation and convection	12·8 ,, ,,
Volatile products, such as gas, tar, and water vapour	10·4 ,, ,,
Formation of carbon compounds	1·5 ,, ,,
Ashes, &c.	0 7 ,, ,,
Balance	14 2 ,, ,,
	100·0

For the regenerative setting, the figures are as follows:—

Plus Items.

Heat from coke	77·4 per cent.
Heat furnished by volatile products	22·6 ,, ,,
	100·0

Minus Items.

Carried up chimney as gases	19·9 per cent.
Carried up chimney as water vapour	5·3 ,, ,,
Removed by hot coke	18·9 ,, ,,
Loss by radiation and convection	19·9 ,, ,,
Volatile products, such as gas, tar, and water vapour	13·8 ,, ,,
Formation of carbon compounds	1·9 ,, ,,
Ashes, &c.	0·8 ,, ,,
Balance	19·5 ,, ,,
	100·0

The figures given by Mr. D. D. Barnum, of Worcester, Mass., U.S.A., in his paper before the New England Association of Gas Engineers in February, 1906, agree very closely with these figures, in view of the fact that in the setting tested by him, the primary and secondary air were heated directly from the furnace, and not from the flue gases. His items were as follows:—

Heat Generated.

	B.Th U.
A. Heat from coke	215,623
B. Heat of formation	37,992
Total heat generated	253,615

Heat Distributed.

	B.Th.U.		Per Cent.
1 Carried up chimney as gases	88,855	..	35·0
2 Carried up chimney as water vapour	31,943	..	12·6
3 Lost in ashes	—	..	—
4 Carried off by gas	15,503	..	6·1
5 Carried off by tar	4,070	..	1·6
6 Carried off by water vapour	3,759	..	1·5
7 Radiation and convection	20,931	..	8·3
8 Hot coke	33,708	..	13·3
9 Heat of formation of gases	3,267	..	1·3
10 Balance of heat utilized to decompose the coal	51,579	..	20·3

The net heat of decomposition would be item 10 − item B + item 9; or 51,579 − 37,992 = 13,587; 13,587 + 3267 = 16,584 B.Th.U., or 6·6 per cent.

It will thus be seen that, according to M. Euchêne, the balance of heat available for the decomposition of the coal is only 14·2 per cent. in the case of the ordinary open-hearth system, and 19·5 per cent. for the regenerative system. Mr. Barnum's figures, however, show for the generator system 20·3 per cent. as available, from which it would appear that the generator was better than the regenerator system (which is not possible). The principal differences between his results and those of M. Euchêne's occur in the heat carried off by the volatile products—9·2 per cent., against 13·8 per cent.; the loss by radiation and convection, 8·3 per cent., against 19·9 per cent.; that removed by the hot coke, 13·3 per cent., against 18·9 per cent.; or a total of 30·8 per cent. for these items according to Mr. Barnum, or 52·6 per cent. according to M. Euchêne.

Then with reference to the different figures for the loss by radiation and convection, this is probably principally due to the fact that the figures given by M. Euchêne were calculated as for a single setting, whereas those of Mr. Barnum are for one setting in a bench of eight settings. Again, the radiation and convection losses from the producer and recuperator, only used in the regenerative settings, are fully one-fourth of the whole. Put into heat units for a similar quantity of coal, Euchêne shows a loss of 33,557 B.Th.U.; Barnum, only 20,931 B.Th.U. Then as regards the heat removed by the hot coke, Barnum deducts the heat of the coke placed in the producer, whereas Euchêne did not do so. This will add 4·4 per cent. to the figure given by Barnum.

But with regard to the volatile products, Barnum only takes account of the moisture found in the coal; but there is also, besides this, an equal quantity formed from the gases. This will add 1·6 per cent. to his figures. Thus we shall have, when we take this 6 per cent. from 20·3 per cent., 14·3 per cent. for the generator setting, 14·2 per cent. for the ordinary setting, and 19·5 per cent. for the regenerator. This is what we might expect when we consider the temperature of the chimney gases, which are about equal in the first two cases at 1800° Fahr.; whereas with the regenerator they are only about 1112° Fahr. It would be very interesting to have a similar test to that made by Euchêne upon a modern regenerative setting with the producer, &c., contained within the arch.

THE LIGHTING AND WATCHING ACT

And Rural District Council Accounts.

ONE of the volumes of the Annual Local Taxation Returns consists of abstracts of returns made by Rural District Councils, Parish Councils, Parish Meetings, Joint Committees appointed wholly by Parish Councils and Parish Meetings, and likewise by Inspectors and Committees under the Lighting and Watching Act, 1833. This is Part III., and the statistics for the financial year 1910-11 were lately issued as a Blue-Book.

At the commencement of the year beginning April 1, 1910, there were 655 rural district councils in England and Wales; and their receipts (exclusive of borrowed money) amounted in the aggregate to £4,764,116. Of this, £3,380,863 was from rates, and £351,661 from grants under the Agricultural Rates Act. From water-works there was a revenue of £196,684; and the balance was made up of various other items. A sum of £1890 was received from an electric light undertaking, and £970 from gas-works. The total receipts, as compared with the previous year, show an increase of £179,973. Expenditure not defrayed out of loans amounted to £4,813,451, an increase of 5·3 per cent. as compared with the preceding year, when the total was £4,571,923. The expenditure on water-works was £187,128, on gas-works £1224, and on electric lighting (excluding cost of public electric lighting) £1821. The sum expended on public lighting was: Electric lighting, £3625; other lighting, £21,930. At the beginning of the year now under review, the aggregate length of roads under the supervision of the rural district councils was 100,901 miles. The receipts from loans in the year 1910-11 totalled £498,195, of which £109,920 was for water-works purposes; and the expenditure out of loans was £515,576, of which £168,137 was for water-works, and £4356 for electric lighting. The total outstanding loans on March 31, 1911, were £6,275,862; the figures for water-works being £1,829,021, for electric lighting £36,800, for gas-works £3003, for public lighting £643. The outstanding loans have increased by 10·5 per cent. during the period from 1906-7 to 1910-11. The assessable value of districts for the purpose of assessment for general expenses was £45,284,759; and for special expenses of contributory places in which rates for such expenses were levied, £23,349,922. The population of the districts according to the preliminary report of the census for 1911, was 7,919,646. The loan charges, for interest and for repayment of capital, amounted to £521,891.

During the year ended March, 1911, there were 7246 rural parishes entitled to parish councils, and 5673 other rural parishes. But only 6682 parish councils had financial transactions in the twelve months, and 391 parish meetings. Rates to meet general expenses were raised for 3772 parish councils and for the parish meetings of 101 parishes not having parish councils. Under the Lighting and Watching Act, 1833, rates were raised for 787 parish councils, and one parish meeting. The actual number of parish councils having transactions under the Act was 1003. The total receipts under the Act were £85,148; and the expenditure, including loan charges, was £85,317. In 25 parishes or lighting districts the Act was administered by inspectors or joint committees; and in these cases, the receipts amounted to £2029, and the expenditure to £2558—in addition to the amounts already mentioned. The rates raised under the Act by parish councils or parish meetings, in respect of buildings or other hereditaments not being agricultural land, amounted to 3d. or under in the pound in 438 cases, over 3d. but not more than 9d. in 343 cases, and more than 9d. in six cases. The total amount of the loans outstanding at the end of the year under review, for the councils and the parish meetings, was £235,904, of which £779 was for public lighting other than electric lighting, and £574 for public electric lighting. Of the 25 parishes or lighting districts in which the Lighting and Watching Act was administered by inspectors or joint committees, in nineteen cases lighting inspectors were appointed under the Act, while in the remaining six there were joint committees appointed under the Local Government Act of 1894 to exercise the powers of lighting inspectors in areas comprised in more than one rural parish. The lighting rates made during the year in respect of houses, buildings, &c., in these districts, varied from 1¼d. to 9d. in the pound; the rates levied in respect of land being in all cases one-third as much. Adding the amounts involved in these districts to the sums received and paid under the Act during the year by parish councils and parish meetings, the total receipts amounted to £87,178, and the expenditure to £87,875.

COLOUR IN ILLUMINATION.

The third lecture by Mr. J. S. Dow was delivered at the Regent Street Polytechnic on Friday, the 7th inst.; the subject being "Colour in Illumination."

The lecturer pointed out how the part played by colour in illumination should be studied from two distinct aspects—the physical and the physiological. From the physical standpoint, it could be shown that there were many ethereal vibrations differing from one another only in frequency and wave length, and yet not usually associated as regards physiological effect. Having cited examples, he passed on to explain how light was produced by incandescence, laying stress on the important part played by temperature in determining the nature of the radiation. The usual method of heating-up a solid body until it emitted light was extremely wasteful. Under these conditions, one obtained a continuous spectrum—*i.e.*, all the visible rays were present; but there was also obtained with them a great proportion of infra-red rays, which yielded no light. In fact, the percentage of energy generated in the luminous form by most incandescent illuminants was very small—perhaps only 1 to 5 per cent. Dr. Drysdale had, however, calculated that at the enormous temperature of the sun as much as 50 per cent. of the total energy might be available in the visible form. This seemed to represent about the limit of efficiency attainable by the incandescence of an approximately black body. It had been calculated that an illuminant which produced the visible rays in the same proportions as daylight, and no others, would yield as much as 25-candle power per watt; whereas the most efficient illuminant at present available did not give more than 4 to 5 candle power per watt.

In one sense an illuminant which emitted only white light might be considered to have a luminous efficiency of 100 per cent. Yet it was evident that, by neglecting the comparatively inefficient red and violet light at the ends of the spectrum, and producing only the yellow-green element, still higher efficiencies might be reached—perhaps as high as 60 candle power per watt. But the use of these selective methods only provided high efficiency at the cost of discrimination of colour. Clearly, in order that colours may appear the same under artificial light as under daylight, all the rays in the spectrum should be present.

The most striking example of luminescence—*i.e.*, the production of free vibrations and only certain rays in the spectrum—was the mercury arc. The Moore and Neon tubes might also be mentioned. In the flame arc lamp recourse was had to the use of chemicals in the carbons, which vaporized and superimposed over the continuous spectrum certain vivid lines in the yellow; and it was to this circumstance that the yellow flame arcs owed their high efficiency. But here, again, the efficiency was accompanied by a certain amount of colour distortion.

Mr. Dow went on to say that the luminous efficiency, from the scientific standpoint, of even the most economical gas lights was probably still relatively low. This was rather a matter for congratulation than otherwise; for it showed that there were still possibilities of great improvement, even beyond the most efficient high-pressure gas-lamps. In particular, it would be observed that these lamps gave a continuous spectrum. There was still, therefore, a possible gain in efficiency by applying the method of selective radiation—*i.e.*, by using mantles which chiefly emitted the valuable yellow-green light.

One could imagine many cases in which all that was needed was a very powerful light, irrespective of colour—for example, a lamp used to illuminate a railway yard by night, or a beacon. In such cases, the foregoing remarks on the value of yellow-green light should be borne in mind. There were also cases in which good penetrating power was needed; and it might then be desirable to produce mainly the red end of the spectrum. In general, however, one needed a light which gave reasonably good colour definition. Such illuminants as the mercury vapour lamp were not intended for use when the appearance of coloured objects was important. When any colour was entirely missing from an illuminant, objects of the same hue naturally appeared very dark. For example, red materials looked almost black under the light from the mercury arc, which contained no red.

Of recent years, the lecturer remarked, there had been a great deal of talk about "artificial daylight." It was perhaps questionable whether for ordinary illumination one required an illuminant closely resembling daylight. People rather liked the more mellow hue of our present illuminants, and sometimes deliberately accentuated the yellow colour by means of appropriate shades. He next instanced certain trades (dyeing and colour printing, carpet manufacture, and the grading of hops and tobacco) in which accurate colour matching was needed, and where artificial daylight was valuable, and remarked that there were two illuminants—the inverted arc light and the Moore carbon dioxide tube—which were claimed to possess a sufficiently close resemblance to daylight to enable this work to be done. Acetylene was also said to closely resemble daylight; but this view was not entirely supported by published tests on the subject. Incandescent gas and electric incandescent lamps were unsuitable for use where accurate colour matching was needed; but they could be converted to this purpose by the use of a suitable screen or filter, altering the colour of the light to an exact replica of daylight.

Mr. Dow exhibited side by side in a small cabinet an ordinary tungsten lamp and a similar lamp equipped with the new Benjamin electric daylight screen worked out by Dr. Kenneth Mees. The difference in the appearance of various coloured objects under the light of the two lamps was very marked indeed. The loss of light occasioned by such a filter was about 80 per cent.; but there were many instances in which this loss would willingly be conceded if only an exact resemblance to natural light could be secured. There seemed no reason why a similar screen should not be worked out for incandescent gas; and Mr. Dow understood that experiments in this direction were in progress.

The remaining portion of the lecture was devoted mainly to an account of the ultra-violet rays. The lecturer mentioned that the recent invention of sources very rich in these rays—such as the quartz tube mercury vapour lamp—had brought to light quite a number of new uses for ultra-violet energy. Among other things, the rays were said to be useful for curing skin diseases, tanning leather, and sterilizing infected water. Another interesting application of these lamps was in connection with the testing of the permanency of colours. Ultra-violet rays, as well as part of the visible spectrum, had also the power of exciting fluorescence and phosphorescence.

In conclusion, Mr. Dow referred to the prejudicial effect of excess of ultra-violet energy on the eyes—an effect which could, however, be guarded against by proper precautions. Yet it must not be supposed that ultra-violet light was invariably prejudicial.

COSMOPOLITAN ENGINEERING.

The Annual Dinner of the Junior Institution of Engineers, last Saturday evening, at the Hotel Cecil, was a great success. There was a large company; and "juniors" were there of all ages, for once a member of the Institution, a life interest in it is established. Association is never allowed, if it can be avoided, to be broken. The President (Sir A. Trevor Dawson, R.N., M.Inst.C.E., was in the chair; and the Chairman of the Institution (Mr. S. Bylander) was in the vice-chair. The engineering side of the naval services of this country, and of Germany, Japan, and America were represented. The home engineering profession generally was strongly in evidence among the guests—all men of high position—at the President's table. At various tables were seen several men associated with gas engineering. Also there were the old Secretary of the Juniors (Mr. Walter T. Dunn), and his successor (Mr. A. Clifford Swales). After dinner, there were speeches and toasts, and an excellent musical entertainment. "The Profession of Engineering" was proposed by Rear-Admiral Waymouth, who described the profession as the leading one of the world. He commented on the advances that have been made, and referred to the internal combustion engine as having revolutionized many of the modes of daily life. He spoke truly when he said that we are living in an age when the brains of engineers are extremely active; and he hoped that British engineers would keep this country well in front, for the activity of other countries, which is welcomed in the cause of progress, makes them strong competitors. There was response by Captain H. Riall Sankey, R.E., M.Inst.C.E. He alluded to engineering as being cosmopolitan. There is no jealousy between engineers of different countries; but he finds there is a sort of parochial jealousy between engineers of the same country. Engineering is so large a science that no engineer knows more than two or three parts thoroughly, and has only a bowing acquaintance with the others, although the Captain is afraid that experts sometimes pretend that their familiarity with the other subjects is greater than it actually is. He thought it was a luminous suggestion that the President made in his Inaugural Address, that the Government should lend a helping hand to young men who show special engineering talent, and who are not in a position to financially help themselves in winning advance in their professional knowledge. Major E. H. Hills, C.M.G., F.R.S., President of the Royal Astronomical Society, proposed the "Junior Institution of Engineers." He congratulated the organization on the high position it holds, and wished it continued prosperity. Engineering and the science that he represents, he considered, might be taken as representatives of the two great lines of development of the human intellect—the practical and the speculative lines. In connection with his own branch of scientific work, it is, he said, often asked, what is the good of useless knowledge?—meaning by "useless," the knowledge which cannot be turned to use on the material side of life. There are no means of knowing what is useless. The useless thing of one generation often becomes the basis of the most severely practical application in the next generation. The desire to know things, apart from all practical application of the knowledge, is a leading characteristic of all those human families who are in the forefront of civilization; and the desire for knowledge forwards the opportunities of the human race. He urged junior engineers not to be immersed too exclusively in the practical side of their profession. Mr. Bylander, in the course of his reply, mentioned that the members of the Institution hope in the not distant future to have a building of their own. The membership has been steadily rising, until, according to the last figures in his possession, it has reached in number 1063. There were other toasts. "Our Guests" was proposed; and Commander Powers Symington, of the United States Navy, Commander Erich von Mueller, of the Imperial German Navy, and Captain Kenji Ide, of the Imperial Japanese Navy, responded. Mr. W. A. Tookey proposed "The President;" and Sir Trevor made response.

AMERICAN INVESTIGATION ON CALORIMETRY.

Results of Tests.

In the last number of the "JOURNAL" (p. 399), we gave a summary of the report presented by the Committee on Calorimetry of the American Gas Institute, on the occasion of the last annual meeting. It may be remembered that the Committee, of which Mr. J. B. Klumpp is Chairman, gave special attention to calorimeters of the continuous-flow type with independent gas-metering equipment, and also to the newer types of calorimeters recently placed on the market, such as the Doherty, the Parr, and the "Sarco." Mr. M. S. White carried out, in the laboratories of the United Gas Improvement Company at Philadelphia, under the immediate direction of Mr. Klumpp, a number of tests; while a larger number were made by Mr. J. N. Lawrence at the Wisconsin University, under the supervision of Mr. O. L. Kowalke, a member of the Committee. Some of the results arrived at are given in the following extracts from the report.

JUNKERS CALORIMETERS.

The first tests were made with the Junkers calorimeter owned by the University of Wisconsin, which was used as a standard in the previous investigations carried out by the Institute. There were four series of tests, the results of which may be summarized as follows: (1) The calorimeter should be operated with water which enters the instrument at approximately the temperature of the room. (2) The most advantageous rate of combustion of the gas is 7 cubic feet per hour; but variations between quite wide limits will cause only a slight error. (3) When operated under the conditions enumerated above, the humidity of the air supplied to the calorimeter has a marked effect upon the efficiency of the instrument. Taking saturated air as the standard, and assuming gas having a heating value of 600 B.Th.U. per cubic foot, the error caused by using unsaturated air is—1 B.Th.U. for each range of 10 per cent. relative humidity below the standard. (4) When operating on a gas having a heating value of 600 B.Th.U. per cubic foot, the efficiency of the calorimeter may be increased 0·5 per cent. by using baffle-plates on the stem of the burner.

Tests were next made with an improved Junkers calorimeter. The fundamental principles of this instrument are the same as those of the older type, but some minor changes have been made. They are mainly as follows: (1) The thermometers are fixed at the same level. (2) The cross section of the instrument is slightly larger than that of the old one; the combustion chamber being slightly enlarged, and some of the piping formerly outside the main body of the instrument being enclosed within the outer shell. (3) The weirs are permanently connected to several feet of metal piping, so that only a small amount of rubber tubing is necessary for the incoming and outgoing water. (4) The delivery-pipe for the outflowing water may be swung through an arc; thus simplifying the operation of switching the water from the drain to the receiving bucket and *vice versâ*. The last change, however, did not prove entirely satisfactory. Spattering occurred to a greater extent than when the old method was used, and therefore a short length of rubber tubing was connected to the end of the delivery-pipe and the water was switched into and out of the bucket in the usual way.

The investigations of this calorimeter may be classed in three main divisions: (1) Determination of the proper rate of combustion of the gas; (2) determination of the effect of the temperature of the inlet water; (3) determination of the absolute efficiency of the calorimeter by checking it against the standard.

In the test to determine the proper rate of combustion, the gas was drawn from the holder used in the previous work on standard Junkers, and other conditions of operation, except the rate of flow of the gas and the position of the damper, were maintained the same. The room temperature averaged 81° Fahr. The damper was wide open, with a natural draught. Maintaining the other conditions constant, determinations were made with the rates of flow shown in the table. The summarized data follow:

Rate of Flow in Cubic Feet per Hour.	B.Th.U. per Cubic Foot.		
	No. 1.	No. 2.	Aver.
3	571·0	571·6	571·3
4	569·6	575·1	572·4
6	583·7	579·4	581·6
7	601·0	599·2	600·1
8	605·1	607·2	606·1
9	598·2	598·8	598·5
10	595·7	595·7	595·7

A curve obtained by plotting the average calorific values per cubic foot as ordinates against corresponding rates of flow as abscissæ, showed a definite maximum when the gas was burnt at the rate of 8 cubic feet per hour. The curve fell off quite rapidly on either side of the maximum. But, inasmuch as many of the features of the improved Junkers calorimeter were different from those of the older type, it was considered desirable to work out an inlet temperature curve for it. The average room temperature was 74·5° Fahr., with a natural draught; and the humidity of the air was 33 per cent. The temperatures of the inlet water ranged from 40° to 80° Fahr.; the differences in temperature of the in coming and outgoing water being 15° to 16° Fahr. The following are the summarized data:—

Temp. of Inlet Water Deg. Fahr.	B.Th.U. per Cubic Foot.				
	No. 1.	No. 2.	No. 3.	No. 4.	Aver.
40	590·8	589·0	587·2	587·6	588 7
50	575·1	574·7	574·7	578·1	575·7
60	566·5	567·3	568·8	566·5	567·3
70	551·7	548 8	554·2	554·3	552·3
80	529·9	530·7	532·2	529·9	530·7

The curve obtained was nearly a straight line, but deviated very slightly between 50° and 60°. When the instrument was checked against the Wisconsin Junkers, the temperature of the inlet water in each was the same, and about 15° below that of the room. In general, the check determinations with the improved instrument agreed fairly satisfactorily; but the agreement was not so close as with the original Junkers. Moreover, with the former instrument variations in the temperature of the inlet water were not noted so quickly by the outlet thermometer as with the latter.

The efficiency of the improved calorimeter was determined by checking it against the other; each calorimeter being operated under its proper working conditions as previously determined. Both instruments were run simultaneously and continuously from the beginning to the end of each series of tests; and alternate tests with each instrument were made. Natural draught was used with both the instruments, and baffle-plates were omitted. The summarized data are as follows—the results being B.Th.U. per cubic foot:

First Series.

	No. 1.	No. 2.	No. 3.	Aver.
Improved Junkers	581·1	578	.. ..	579·6
Original Junkers	581·4	580	579·4	580·3

Second Series.

	No. 1.	No. 2.	No. 3.	No. 4.	Aver.
Improved Junkers	580·6	583·4	578·5	581·1	580 9
Original Junkers	584·7	582·6	581·9	581·0	582·5
Average of Nos. 2, 3, and 4	..	..	..	..	581·8

It will be seen from these figures that the improved Junkers calorimeter gave results slightly lower than the other; but the difference is small—being practically within the limits of experimental error.

The results of the investigations in connection with the improved calorimeter may be summarized as follows: (1) The proper rate of flow of the gas is 8 cubic feet per hour; and any considerable variation from this rate of combustion will cause the instrument to register low heating values. (2) The calorimeter should be operated with water which enters the instrument at approximately the temperature of the room. (3) When the calorimeter is operated with the damper closed, incomplete combustion results; and it was necessary with this instrument to have the damper wide open for perfect combustion. (4) The presence of baffle-plates on the stem of the burner increases the efficiency of the instrument by 0·7 per cent. (5) When operated under proper conditions, the efficiency of the instrument for determining gross heating values is the same as that of the original instrument. (6) The device for switching the outflowing water into and out of the receiving bucket is not entirely satisfactory because of the spattering of the water which occurs. (7) Some water is condensed out of the products of combustion within the combustion chamber. This water drips from the base of the calorimeter, and renders the volume of the measured water of condensation too small. (8) Variations in the temperature of the inlet water are not noted as quickly by the outlet thermometer as is the case with the original Junkers. (9) Both thermometers being on the same level, readings can be taken with less inconvenience than when using the last-named.

AMERICAN METER COMPANY'S CALORIMETER.

The American Meter Company's calorimeter used in this investigation was in all fundamental principles a Junkers calorimeter. A considerable number of minor changes have, however, been made, which facilitate the operation of the instrument. These

changes may be summarized as follows: (1) Both thermometers are on the same level. (2) Special gaskets are provided for securing the thermometers in place. (3) The absorption chamber can be removed from the outer shell of the instrument, thus facilitating cleaning operations. (4) Baffle-plates are provided for the burner. (5) The burner has a flat circular base, so that the burner will remain in an upright position when unsupported. (6) The burner top screws on to the stem. (7) An adjustable mirror enables the operator to note the gas-flame. (8) A small plumb-bob is provided for levelling the instrument. (9) The position of the damper is indicated by a pointer and scale. (10) A three-way cock affords means of directing the outflowing water either to the receiving bucket or to the drain. (11) A vent is provided to obviate the trapping of air around the three-way cock.

Inasmuch as the basic principles of the instrument are the same as both forms of the Junkers calorimeter, it was not deemed necessary to work out the proper rate of combustion of the gas or the proper relation between the temperature of the inlet water and that of the room before making comparative tests. The only work done with this instrument was to make two series of comparative tests between it and the original Junkers calorimeter.

Both calorimeters were worked under identical conditions; these being the standard conditions for the old form of the Junkers calorimeter, as previously determined in the investigation. The instruments were operating continuously and simultaneously throughout each series of tests. Baffle plates were placed upon the stems of the burners; and a natural draught was used. The summarized data are as follows—the results being, as before, B.Th.U. per cubic foot:

First Series.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	Aver.
Am. Meter Co.'s cal. .	571·5	569·4	570·2	569·6	570·6	570·3
Original Junkers . .	571·9	571·5	570·0	570·9	571·5	571·2

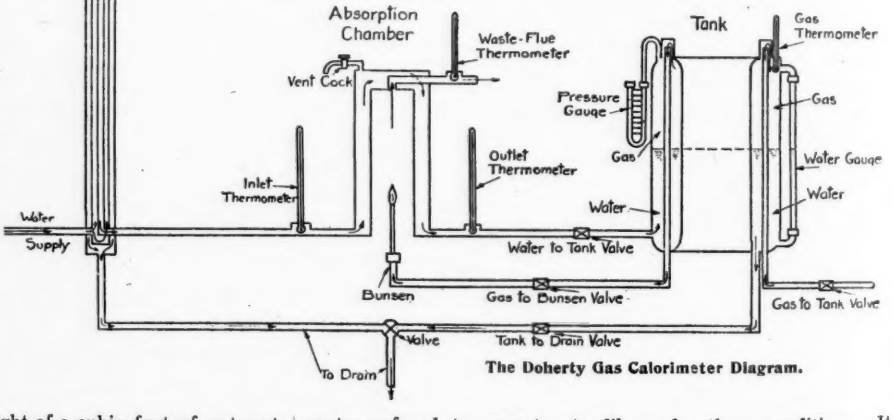
Second Series.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	Aver.
Am. Meter Co.'s cal. .	586·7	585·9	583·8	581·2	581·4	583·8
Original Junkers . .	587·1	586·5	583 5	582·2	580·0	583·9

From the above series of tests, the following conclusions can be drawn: (1) When operated under the standard conditions for the old type of the Junkers calorimeter, the American Meter Company's calorimeter gives the same efficiency as the Junkers. (2) All the changes previously enumerated appear to be advantageous, and can truly be termed improvements.

The Doherty Calorimeter.

Inasmuch as this calorimeter is radically different, in construction and operation, from any other calorimeters on the market, a detailed description of it is given in the report. It is not new to our readers, as it was described and illustrated in the "Journal" for Dec. 27, 1910 (p. 918); but it will be useful to reproduce the following diagram, with the accompanying particulars, from the report under notice. The fundamental principle of the calorimeter is the direct displacement of the gas under test by the water which is heated by the combustion of the gas—thus maintaining the ratios of volume absolutely constant. The pressure is imparted to the gas by the displacing water; and this water secures its constant pressure from a constant static head in the regulator. Every cubic inch of water passing through the heat-absorbing chamber is heated by the burning of a cubic inch of gas displaced by the water. This being the case, determination of the heating value in British thermal units per cubic foot becomes a question of measuring temperatures, with suitable corrections for existing conditions of temperature of the gas and the pressure on the gas. The observed heating value of the gas is obtained by multiplying the rise in temperature by the weight of a cubic foot of water at the temperature at which it enters the gas-tank. To obtain the corrected heating value, the observed heating value is divided by the usual correction factor which reduces the gas volume to standard conditions—viz., 60° Fahr. and 30 inches of mercury. Measurement of gas and weighing of water are consequently necessary with this instrument.



The Doherty Gas Calorimeter Diagram.

It will be seen from the diagram that the Doherty calorimeter has two essential parts—the absorption chamber and the tank. Both of these are cylinders of annular section, the former being placed within the latter. A layer of felt guards against interchange of heat through the walls. The regulator is simply a stand-pipe in which a constant head or pressure is maintained by means of a supply of flowing water, part of which escapes to the drain—the remainder keeping the stand-pipe full, as displacement occurs in the tank. The exhaust gases are expelled through a vent located near the top and on the front of the instrument. No damper is provided in the vent. The tank has a gauge-glass for indicating the water-level inside, and a U-gauge showing the pressure on the gas in inches of water. The gauge-glass is divided into nine equal parts, the volume between the extremes being exactly one-third of a cubic foot. A thermometer extends into the top of the tank, and indicates the temperature of the gas. The water passes from the stand-pipe through the absorption chamber and into the tank. An arrangement of adjustable baffles within the chamber makes it possible to adjust the absorption surface so that the products of combustion can be delivered to the atmosphere at varying temperatures without changing the temperature of the inlet water. The gas and water supplies are controlled by suitable valves.

The method of making a determination may be outlined as follows: The tank is filled with gas to be tested, and the supply shut off. In order to fill the tank with gas, it must first be filled with water. The gas-supply valve is then opened, and the water allowed to run out; gas being drawn into the tank. Water is admitted from the stand-pipe, imparting regulator pressure of the gas. The pressure can be varied to some extent by a manipulation of valves. The bunsen burner is lighted, and set in position in the combustion chamber. When the water-level in the gauge-glass has risen to the first graduation, the temperatures of both inlet and outlet water are read, and such readings are repeated as the water-level passes each graduation on the gauge-glass—thus giving ten readings in all. The average of the ten readings on each thermometer is taken as the basis of the test. After applying the corrections to the average readings on each thermometer, the difference between the corrected average readings gives the temperature interval through which the water was heated.

The investigation of the Doherty calorimeter may be divided thus: (1) Determination of the proper rate of combustion of the gas; (2) determination of the proper relation between the temperature of the inlet water and the room temperature; (3) determination of the efficiency of the calorimeter by checking it against original Junkers calorimeter; (4) subsequent investigations.

By proper manipulation of the valves, somewhat varying pressures on the gas in the tank may be produced. Of course, the greater the pressure, the faster will be the rate of flow of the gas to the bunsen burner. It was found possible to produce rates of flow varying from 0·5 cubic foot to 2·5 cubic feet per hour. While holding all other operating conditions constant, the calorimeter was operated upon the same sample of gas, employing the following different rates of flow in the order named—viz., 0·327, 0·590, 1·115, 1·726, and 2·428 cubic feet per hour. Two determinations were made with each rate of flow; the summarized data (B.Th.U. per cubic foot) being as follows:

Rate of Flow.	No. 1.	No. 2.	Aver.
0·327 . . .	576·0 ..	572·8 ..	574·4
0·590 . . .	601·3 ..	607·2 ..	604·3
1·115 . . .	600·6 ..	598·6 ..	599·6
1·726 . . .	601·2 ..	599·8 ..	600·5
2·428 . . .	594·5 ..	599·5 ..	597 0

It is noticeable that the results at the first two rates of flow are rather discordant. Considerable effort and time were expended to get concordant results with slow rates of flow; but the calorimeter refused to operate steadily under these conditions. It seemed to give practically uniform results with all the higher rates of flow obtainable. However, it was found that a pressure of 2 inches of water was the most constant one obtainable with the instrument; and as this pressure gave a rate of flow of about 1·7 cubic feet per hour, it was adopted as the standard for the calorimeter.

To ascertain the effect of the temperature of the inlet water, two series of tests were made. The first tests were of a preliminary nature, and were particularly designed to note the effect of changing the surface exposed in the absorption chamber by manipulation of the pointer at the top of the instrument. This pointer is connected with adjustable baffles within the absorption chamber, by means of which the absorbing surface may be increased or diminished; thus lowering or raising the temperature

of the exhaust gases. The first tests were made with water ranging in temperature from 55° to 85° Fahr., with a room temperature averaging 76° Fahr. Two consecutive tests were made; and the results are summarized below:

Temp. of Inlet Water. Deg. Fahr.	B.Th.U. per Cubic Foot. No. 1.	No. 2.	No. 3.	Room Temp.	Exhaust Temp.
55	628·2	630·2	629·2	77·3	77·0
60	626·2	627·6	626·9	76·1	76·1
65	617·3	616 6	617·0	76·1	76·1
70	613·1	612·5	612·8	77·3	79·2
75	606·7	606·7	606·7	77·8	82·7
80	604·0	603·4	604·1	78·1	87·2
85	597·6	—	597·6	78·6	93·0

It is of interest to note that for the first three inlet water temperatures the temperatures of the exhaust gases and of the room are identical; yet the heating value of the gas was successively lowered as the temperature of the inlet water was raised. It is not easy to explain this phenomenon from the work recorded up to this point; but subsequent investigation offered a partial explanation. The Committee say that about the only conclusion of any value to be drawn from these results is that the Doherty calorimeter does not give the same heating value of a gas with different temperatures of inlet water, even though the exhaust gases are at the same temperature in all cases.

In order to check the results just reviewed, two other tests were made at a later date. These tests were conducted as follows: With the maximum surface of the absorption chamber exposed, a series of tests was made with the temperature of the inlet water about 20° below that of the room. Then the temperature of the inlet water was lowered about 8°, and the surface of the absorption chamber decreased, by moving the pointer, so that the exhaust gases left the calorimeter at the same temperature as in the first case. Then a second series of determinations was made, with the following results:

First Test.

Temp. of Inlet Water. Deg. Fahr.	B.T h.U. per Cubic Foot. No. 1.	No. 2.	No. 3.	Aver.	Room Temp.	Exhaust Temp.
54·8	626·6	625·2	623·3	625·0	75·0	66·5
48·5	634·4	633·1	634·4	634·0	75·0	66·5

Second Test.

58·4	591·4	592·1	592·1	594·1	71·3	69.0
52·4	600·1	594·9	598·8	598·8	71·5	69·0

The results of these two series confirm the conclusions drawn from the results of the previous series. The heating values registered by the calorimeter increase as the temperature of the inlet water decreases, even though the temperature of the exhaust gases remains constant. The only explanation of the results obtained in this connection seemed to be this: Inasmuch as the gas is displaced by water, and is in contact with the water for about 20 minutes, it is reasonable to suppose that there may be some absorption of carbon dioxide from the gas during a test, for carbon dioxide is the most soluble in water of any of the constituents of ordinary illuminating gas. It is also a well-known fact that the solubility of carbon dioxide in water is greater the lower the temperature of the water. Therefore it was thought that the higher values obtained with the colder water might be explained in part by an increased absorption of carbon dioxide from the gas during the test. In order actually to determine the extent to which this absorption took place during a test, a special series of experiments was carried out. They showed that the average of the carbon dioxide content of the gas passing directly through the calorimeter before and after the absorption tests was 3·2 per cent. of the total volume of the gas; and with a gas having this carbon dioxide content, the absorption taking place while making a test will reduce the percentage to 2·7 per cent.—that is to say, the percentage of combustible in the gas is increased by the same amount (0·5 per cent.).

In the light of the experiments just reviewed, it would seem that variations of the surface exposed in the combustion chamber made to neutralize the effect of different temperatures of inlet water introduce a factor which cannot be satisfactorily explained from the present data.

The second series of tests made with different temperatures of inlet water was conducted as follows: The pointer at the top of the absorption chamber was set so as to expose the maximum surface in the chamber; and the gas was burnt at the rate of 1·7 cubic feet per hour. Two determinations were made. Natural draught was used; and the relative humidity of the atmosphere was 25 per cent. The summarized data (B.Th.U. per cubic foot) are as follows:

Temp. of Inlet Water. Deg. Fahr.	No. 1.	No. 2.	Aver.
40	623·2	625·1	624·2
50	609·2	611·2	610·2
60	604·3	601·6	603·0
70	589·8	589·8	589·8
80	576·1	574·7	575·4

A curve plotted from the results of this series of tests shows that the lower the temperature of the inlet water, the higher are the heating values registered by the calorimeter. The drop in heating value with an increase in the temperature of inlet water is uniform up to 60° Fahr., at which point there is a marked change in the slope. The Doherty calorimeter should be operated with water at approximately the temperature of the room, and corrections should be made for humidity.

The efficiency of this calorimeter was determined by checking it against the original Junkers. Both calorimeters were operated with the inlet water ranging from 15° to 20° Fahr. below the room temperature. The rate of flow of gas in the Doherty calorimeter was 1·7 cubic feet per hour; in the Junkers, 7 cubic feet per hour. The former instrument was operated with natural draught, the air supplied having a humidity of about 26 per cent.; the latter with forced draught, the air supplied having a relative humidity of about 93 per cent. Alternate tests were made with each instrument. The summarized data are as follows:

First Series.

	No. 1.	No. 2.	No. 3.	No. 4.	Aver.
Junkers	594·2	595·6	593·8	594·3	595·4
Doherty	590·1	596·2	597·8	594·5	594·7

Second Series.

Junkers	599·9	600·8	600·3	601·1	600·5
Doherty	600·0	600·0	600·0	596·8	600·0*

* Average of Nos. 1, 2, and 3.

Third Series.

Junkers	606·5	605·8	605·9	—	606·1
Doherty	607·1	606·6	605·8	—	606·5

The results obtained with the Doherty calorimeter seem to indicate that the condensing and absorbing surface was of sufficient capacity to condense all the water vapour resulting from the combustion of the gas, and that practically no vapour left the instrument by mechanical entrainment. When operating this instrument with a gas consumption of 1·7 cubic feet per hour, and with the inlet water temperature 20° Fahr. below that of the room, and with an air supply of 26 per cent. humidity, readings were obtained which were of the same magnitude as those obtained with the Junkers calorimeter operated with air which approximated saturation.

The Committee say that if the air supply to the Doherty calorimeter had been nearly saturated, as it was in the Junkers, concordant results would have been obtained with the inlet water at room temperature. They remark that it seems as though the absorbing and condensing surface in the instrument is adequate to make available for record the latent heat of condensation of all the water resulting from combustion. Inasmuch as the percentage of carbon dioxide in illuminating gas is moderately constant, the positive error produced by this factor will be fairly constant—being about 0·5 per cent. The drop in heating value registered between the inlet temperatures of 55° and 60° was 6 B.Th.U. The average relative humidity of the air in the building where these tests were performed was about 24 per cent. during the winter months, and from 80 to 90 per cent. during the summer months. Thus, changes in humidity occurring at different periods of the year would cause a maximum variation in the heating values of about 6 B.Th.U. Assuming a gas having a heating value of 600 B.Th.U. per cubic foot, the change in the heating value caused by the resultant effect of humidity and carbon dioxide absorption will vary from about − 4 B.Th.U. in the winter to approximately +2 B.Th.U. in the summer.

The results of the investigations of the Doherty calorimeter may be summarized as follows:

1.—The gas burnt does not have to be metered; hence errors resulting from improper measurement of the gas volume are avoided.

2.—The heated water is neither weighed nor measured; hence errors arising from either of these conditions are obviated.

3.—The proper pressure to be maintained on the gas in the tank is 2 inches of water. This gives a rate of flow of gas of 1·7 cubic feet per hour.

4.—The calorimeter should be operated with water at approximately the temperature of the room, and correction made for humidity as given in the tables.

5.—The efficiency of the instrument, when operated as indicated in Nos. 3 and 4, is the same as the original Junkers.

6.—There is sufficient condensing and absorbing surface so that no water vapour is carried out of the calorimeter by mechanical entrainment in the products of combustion when the temperature of the inlet water is regulated to suit the conditions of humidity.

7.—Unsteady operation is sometimes caused by the trapping of air in the system of pipes within the calorimeter. When these conditions prevail, no determination should be attempted until the trouble has been removed.

8.—Occasionally the passage of the gas into the tank is obstructed by an accumulation of solid matter. This is particularly the case if the instrument is allowed to stand idle for a time after having been in use for several weeks.

9.—Variations in the temperature of the inlet water are noted fairly quickly by the outlet thermometer, but not quite so quickly as is the case with the original Junkers.

10.—The time required for making a determination is twenty minutes.

11.—Baffle-plates used on the stem of the bunsen burner did not exert any appreciable effect.

12.—Changes in the amount of surface exposed in the absorption chamber introduce complications which are not easily explainable. It is recommended that the calorimeter should be always operated with the maximum surface of the absorption chamber exposed to the products of combustion.

13.—Check determinations agree satisfactorily.

14.—The rise in temperature of the water as it passes through the calorimeter is about 9·5° Fahr. Therefore any error in reading the temperatures will cause a somewhat greater percentage error in the results than is the case with the Junkers calorimeter, in which the water is heated through a temperature interval of from 15° to 16° Fahr.

15.—When operating on average illuminating gas, an absorption of 0·5 per cent. of carbon dioxide occurs during a test.

16.—A calorimeter case is provided for the instrument, and the calorimeter can be operated while in position within the cabinet. Thus the instrument is easily protected from dust and fumes.

17.—The calorimeter is easily portable, and does not have to be taken apart for shipment.

18.—The mechanical construction of the pressure-gauge should be improved.

[Further notice of the report is reserved till next week.]

GAS MANUFACTURE, GAS-WORKS CONSTRUCTION, AND MANAGEMENT.

By J. G. NEWBIGGING, M.Inst.C.E.

THE subject of "Gas Manufacture, Gas-Works Construction, and Management" has recently been dealt with in two lectures delivered at the Manchester University by Mr. J. G. Newbigging, M.Inst.C.E., the Corporation Gas Engineer. The lecturer necessarily brought before his audience matters with which "JOURNAL" readers are familiar; but there were points of interest which it may be useful to indicate. The lectures, which were illustrated by diagrams, models, and lantern slides, were greatly appreciated. We give below an abstract of the first lecture; leaving till next week a notice of the second, which was delivered last Thursday.

INTRODUCTORY.

In introducing his subject, Mr. Newbigging remarked that the time at his disposal was not sufficient to enable him to deal with its more scientific and technical details; but he pointed out that the gas industry is rich in the number of its text-books and other literature, and to them he referred those of his audience who desired to become better acquainted with it.

Starting with the early days of coal-gas manufacture, which is nearly a century-and-a-quarter old, the lecturer said it might be justly described as one of the most important industries in the world. From £130,000,000 to £140,000,000 is invested in it in the United Kingdom alone; in addition to enormous sums, difficult to estimate, employed in manufactories producing the plant for making gas appliances for its utilization. Though Murdoch realized his dream of employing as a lighting medium gas produced from coal, there was much to be done to render the new illuminant acceptable. The impurities in the crude gas were found to be many and objectionable; and means and apparatus for their elimination had to be devised. Suitable pipes for the conveyance of the gas to the point of combustion were also required. Murdoch devoted much time and effort in these directions. Other ingenious minds were early at work in this promising field to the labourer, chief among the pioneers being Clegg, who, in 1805, began to apply himself to the invention and construction of gas apparatus, and introduced the new method of illumination into many large establishments in different parts of the country. He invented the hydraulic main, the lime purifier, and the wet gas-meter; and in connection with the last-named appliance he was ably seconded by John Malam, who perfected it. The new art of gas lighting was fortunate in many of its early exponents. At first it did not meet with success; but great improvements were effected in the plant, and the chemical and mechanical principles involved in the production of gas are every year becoming better understood by gas engineers.

SITE FOR WORKS AND ARRANGEMENT OF PLANT.

With these introductory remarks, Mr. Newbigging proceeded to consider the details of the construction and operation of gas-works. Dealing first with the question of site, he pointed out that it should be in as close proximity as possible to the district to be supplied. He next considered the disposal and arrangement of the various buildings, and emphasized the necessity for leaving space for additions as the output of gas increases. One of the evidences of good administrative skill in the conduct of gas-works is ensuring that extensions are carried out systematically and with foresight, and as gradually as possible; not postponing them to the last extremity, which Mr. Newbigging says is "the worst possible policy for the undertaking and all connected with it." The area of land required for gas manufacturing purposes is from 1½ to 2 acres per million cubic feet produced per diem.

CAPITAL OUTLAY.

Coming to the question of the cost of works and distributing plant, Mr. Newbigging said it was almost impossible to give a series of coefficients of the number, dimensions, and cost of buildings, apparatus, machinery, and plant applicable to the individual case of every gas-works. The capital of large gas undertakings might be taken at about £500 per million cubic feet of gas sold per annum, divided as follows: Land, buildings, and manufacturing plant, £250; distributing plant, £238; tar-distilling plant and sulphate works, £12. These costs were given on the assumption that 65 per cent. of the consumers were using gas through ordinary meters, and 35 per cent. through prepayment meters; also that one-third of them were employing gas for heating and cooking purposes. The figures show that there is very little difference in the cost of the manufacturing and distributing plant; but twenty years ago the former was much in excess of the latter. With the increasing use of gas through prepayment meters, and for heating, cooking, and motive power, the distributing plant will entail a greater outlay than that required for the production of the article distributed.

COST OF PRODUCING GAS.

The average cost of producing and distributing illuminating gas in England is, roughly, two-thirds of the selling price. Taking 2s. per 1000 cubic feet, it will be 1s. 4d. The coal will cost 1s.; but deducting the value of the residuals, its net cost will be 3d.; and the balance is made up of the working expenses. The difference of 8d. between the prime cost and the selling price of the gas is absorbed, in the case of a municipal gas undertaking, in the discharge of the interest on the borrowed capital, the provision of a sinking fund, and "unfortunately," said Mr. Newbigging, "in many cases in the payment of a large sum in relief of rates." It is the aim of gas engineers to pay for the cost of the coal out of the receipts for residuals. As a matter of fact, there are a few undertakings favourably placed for the disposal of products where there is a balance after paying for the coal; but, speaking generally, if 80 per cent. of the cost is returned, Mr. Newbigging considers it is satisfactory.

STORAGE AND SPONTANEOUS COMBUSTION OF COAL.

These were the next subjects taken up. The lecturer pointed out that it is usual to have sufficient coal in stock to satisfy requirements for from four to six weeks, calculated on the basis of the heaviest day's consumption. The necessity for such provision was evidenced by the coal strike which took place during the early part of last year. At the commencement of the strike, Mr. Newbigging had 50,000 tons of coal in stock, and only 16,000 tons at its conclusion; but if the strike had continued another three weeks, he would still have been able to maintain the supply of gas. The largest stock held this winter was 65,000 tons; and at the date of the lecture [the 30th ult.] it was 52,000 tons. Though he had this quantity of coal in stock, and so felt safe from the anxieties of a possible cessation of deliveries, his troubles did not end there. He pointed out that stacked coal depreciates in value, particularly when it is in the open, for it not only gets wet on its surface, but retains moisture in its structural interstices. The effect of this is to cause it to disintegrate and produce dust. The greatest depreciation of coal takes place during the first twelve months; after that it is much slower. When using coal out of stock, it is the practice to mix it with some that has been freshly wrought, in order to mitigate the loss which ensues in using it alone, through the lessened production of gas per ton.

The lecturer went on to explain that all bituminous coals are liable to take fire when stored for some time, owing to the absorption of oxygen from the air, and the resulting oxidation of the carbon of the coal. He said some engineers suggest that coal should be so closely packed that very little air can circulate; and a proposal has been made that coal should be stacked over a system of refrigerator pipes through which brine is passing. Mr. Newbigging gave the following as the temperatures at which coal will fire spontaneously: Cannel, 689° Fahr.; Hartlepool coal, 766° Fahr.; Welsh steam coal, 870° Fahr. He said the subject of the spontaneous ignition of coal was a much-debated one, and there was great diversity of opinion upon it; but his experience was that it could be entirely prevented by thorough ventilation throughout the mass of coal.

HANDLING OF MATERIAL.

The subject just dealt with naturally led to that of the handling of material, the efficiency and economy of this in large gas-works being characterized by the lecturer as of the utmost importance. In Manchester, for example, nearly 500,000 tons of coal are used per annum, or a maximum of about 1600 tons daily; and from this quantity of coal there are produced 280,000 tons of coke. They have consequently about 780,000 tons of solid material to deal

with, besides 18 million gallons, or 91,000 tons, of tar and ammoniacal liquor. Mr. Newbigging explained the arrangements for dealing with the coal and coke, and said the object to be aimed at in handling the latter was to produce as little breeze as possible, as its value is from 50 to 60 per cent. less than that of coke, and to adopt the mechanical means which would best withstand the heavy wear and tear of the action of the hot and gritty coke and the water used for quenching it. After a long experience of all methods of removing coke, he said he had found the trough chain conveyor the most effective, the cost of which complete per foot run was £3. Having described the conveyor, he said they had dealt with 100,000 tons of coke in one of the Manchester retort-houses, at a cost for power and renewal and maintenance of plant of 1½d. per ton of coke; the power required being 3 B.H.P. per 100 feet.

Carbonization of Coal.

Mr. Newbigging now came to what he said was perhaps the most important part of his lecture; and he explained at the outset that it was only possible to give his audience a brief survey of the subject, and deal with general principles. He said there was a well-known adage in the gas industry that "dividends are made in the retort-house;" and it was quite true, because in the careful selection and efficient management of the carbonizing plant depends largely the quality and the quantity of gas, coke, and tar produced. These control the price at which gas can be sold; and, in the present days of competition, the lower the price of gas, the greater the chance of the success of the gas industry. In no section of a gas-works had greater development taken place in the past twenty years than in the method of carbonizing coal; and during the latter half of this period there had been a positive revolution in constructional detail and system of working. He reviewed briefly the changes which have taken place in the setting of retorts, and pointed out as a curious fact that Murdoch, in the early days of gas manufacture, used small iron retorts set vertically, but that the difficulty experienced of withdrawing the residual coke led him to abandon the arrangement in favour of inclined retorts, and eventually to adopt the horizontal position. This was the system universally employed until, about twenty-five years ago, M. Coze reintroduced retorts set at an angle of 30 to 32 degrees from the horizontal. This system found considerable favour, because the charging and drawing operations were largely effected by the natural gravitation of the material—thus saving a considerable amount of labour, and dispensing with stoking machinery.

The charging of retorts by gravity has always been an ideal of gas engineers; and many attempts have been made from time to time to devise a vertical retort which would be a practicable piece of apparatus when working on a large scale. Mr. Newbigging referred to Brunton in 1828, Rowan in 1885, and Settle and Padfield in 1902, as early pioneers in this direction; but he said it remained for Dr. Bueb to make vertical retort carbonization a practical success. His system was an intermittent one which had found great favour on the Continent. Messrs. Woodall and Duckham were the first to introduce vertical retorts successfully working on the continuous principle; and this system had in many respects been further improved by Messrs. Glover and West. It would therefore be seen that there was a gradual reversion to the idea of vertical retort carbonization which was in the mind of Murdoch at the inception of gas manufacture.

The lecturer next showed how the iron retorts originally employed, and generally used till well into the middle of the last century, had given place to others made of fire-clay. After giving a few details of the sizes of settings and the capacity of retorts, Mr. Newbigging turned to the subject of heating them; and he pointed out that the object aimed at was to use as little coke as possible for the purpose, so as to leave a large proportion for sale. He explained the direct-fired system, which he characterized as "scientifically wasteful and imperfect," and that of gaseous firing, which he said has, "from a practical as well as a theoretical point of view, everything to recommend it."

Intermittent *v.* Continuous Carbonization.

The concluding portion of the lecture was devoted to this subject. Mr. Newbigging began by expressing the opinion that all systems of intermittent carbonization are more or less wasteful and unscientific, and that within the next twenty years they will be entirely displaced by the more scientific and economical system of continuous carbonization in vertical retorts, which, he said, "gas engineers should welcome because it is placing on a sound scientific basis the distillation of coal for the production of illuminating gas." He explained why he had used the words "wasteful and unscientific." He pointed out that in carbonizing coal in horizontal retorts the charge is left for six hours, at the end of which period the coke is removed and the process repeated. The effect of this is that the gas differs during every hour in illuminating power, composition, and calorific value; and the only means the gas manufacturer has of maintaining a uniform quality of gas is by mixing in the holder, and depending upon the fact that all the retorts are not charged at one time. The heat of the retorts may become lowered, and the discharged coke contain a large proportion of the volatile matter which should have gone to the holders; or, on the other hand, the heat of the setting may have become so high that the whole of the gas has been evolved from the coal long before the end of the distillation period, with the result that there is an increase in the less valuable constituents of the gas. Further, there is waste of gas each time the retorts are charged by machinery. In the working of horizontal retorts, there is no possibility of avoiding this under or over carbonization of coal or waste of gas. "Contrast these conditions," said Mr. Newbigging, "with those obtaining in continuous carbonization in vertical retorts. Here you have a system which, from whatever point of view you make a comparison, results in its favour." He added that he wished to draw the particular attention of his audience to this system, because it represented the last word in carbonizing coal for the production of gas for illumination or heating. He acknowledged that the structural cost of vertical retorts exceeds that of horizontal retorts and machinery by from 10 to 15 per cent.; but he submitted that the facts that carbonizing costs can be reduced by at least one-half of the best results obtained with horizontal retorts and machinery, and that twice the quantity of gas can be made on the same area of land—to name only two advantages of the system—far outweigh the extra cost of installation.

In order to show the difference in the composition of the gas at various stages from the commencement of carbonization in the two systems compared, Mr. Newbigging gave the following tables:

Horizontal Retorts (Intermittent System).

	½ Hour.	1½ Hours.	2½ Hours.	3½ Hours.	5 Hours.
Sulphuretted hydrogen	3·8	3·1	2·8	2·1	1·2
Carbonic acid	3·0	2·8	2·6	2 3	1·7
Ethylene and benzene	8·7	5·2	3·6	2·4	—
Oxygen	—	—	—	—	trace
Carbon monoxide	4·3	5·0	4·9	4·5	3·8
Hydrogen	29·8	37·5	42·2	46·2	60·8
Marsh gas	49·7	42·0	39·4	37·5	26·3
Nitrogen (difference)	0·7	4·4	4·5	5·0	6·2
Calorific value (B.Th.U.)	809·7	678·2	629·8	594·5	469·1

Glover-West Vertical Retorts (Continuous System).

	10.30 a.m.	11.30 a.m.	12.30 p.m.	1.30 p.m.	2.30 p.m.	3.30 p.m.
Sulphuretted hydrogen	0·95	0·96	0·95	0·95	0·93	0·93
Carbonic acid	0·80	0·90	0·80	0·80	0·80	0·80
Ethylene and benzene	2·80	2·80	2·80	2·74	3·10	3·10
Oxygen	0·30	0·30	0·30	0·20	0·30	0·30
Carbon monoxide	6·30	6·50	6·50	6·10	6·50	6·50
Hydrogen	56·63	56·82	56·61	57·13	55·60	56·79
Marsh gas	29·33	28·83	28·67	29·37	29·17	29·17
Nitrogen (difference)	3·84	3·85	4·42	3·65	4·53	3·34
Calorific value (B.Th.U.)	561·1	557·4	554·7	561·0	563·8	567·6

The lecturer passed on to deal with other advantages of the continuous system—viz., the entire absence of nuisance from the emission of smoke and steam, the smooth and noiseless working of the plant, the saving in the wear and tear of conveyors when dealing with comparatively cold as compared with incandescent coke, the cleanliness of the retort-house, and the complete absence of all the disagreeable conditions prevailing with other systems of carbonization. Other advantages mentioned were a higher yield of gas of more uniform quality per ton of coal, absence of naphthalene deposits in the mains and service-pipes (the quantity in the distributed gas never exceeding 1 to 2 grains per 100 cubic feet, compared with 10 grains or more with intermittent carbonization), and regularity of output from the retorts. This regularity increases the efficiency of the condensing and purifying plant; and the production of tar is about 20 per cent. greater, is of better quality, and fetches higher prices.

The lecturer explained the continuous system by the aid of a diagram, and concluded by thanking his audience for the attention they had given to his lecture.

Rainfall Last Year.—In "Symons's Meteorological Magazine" for January, Dr. H. R. Mill, the Director of the British Rainfall Organization, gave an interesting account of the rainfall of the British Isles for the year 1912, prepared from a preliminary examination of some of the data at his disposal. It shows that the rainfall over the whole of the country was in excess of the average, with the exception of very limited areas. England and Wales had an excess of 21 per cent., Scotland 7 per cent., and Ireland 9 per cent. The wet months were January to March, June to August, and December. Of the remaining months, April and September had only about half the average.

Manchester District Institution of Gas Engineers.—As notified in the "Journal" last week, the annual meeting of the Institution will be held next Saturday. According to the programme issued by the Hon. Secretary (Mr. W. Whatmough, of Heywood), the members will assemble in the Grand Hotel, Manchester, and the business will include the introduction of three new members—Mr. W. B. M'Lusky, of Halifax, Mr. S. Cutler, of Belper, and Mr. Hedley Hoy, of Tyldesley—the presentation of the annual report and accounts and the reports of the Commercial Sections, and the induction of the President-Elect (Mr. J. C. Belton, of Chester), who will deliver his Inaugural Address. As mentioned last week, Mr. James Lomax, of Bolton, will contribute a paper. We now learn that its subject will be "Coal and its Constituents as Revealed by the Microscope." Mr. Lomax, it may be remembered, in conjunction with his son (Mr. J. R. Lomax), exhibited at the meeting of the Institution last November, a number of coloured slides showing different sections of coal formation. At the close of the business, tea will be served; and the President will afterwards hold the usual reception.

THE CARBONIZATION OF GAS COAL IN LARGE QUANTITIES.

Effect on the Discharge and Quality of Coke.

In the "Journal" for the 24th of December (p. 965) reference was made to some tests of coal carried out by Signor D. Meneghini, at the Padua Gas-Works, with the view of ascertaining the cause of the difficulty sometimes experienced in discharging the coke yielded by certain coals when carbonized in chamber ovens. A detailed account of the tests was given in a recent number of the "Gazzetta Chimica Italiana," and the following particulars have been translated therefrom.

The author begins by pointing out that during the past ten years plant has been extensively adopted in which much greater quantities of coal are carbonized than was the case with the first Liegel and Lachomette retorts; and quite recently chamber ovens have been introduced, exactly similar to those utilized for the production of foundry coke. Analogous to these horizontal retorts are the vertical and inclined retorts, in which the coke is discharged by gravity or by the aid of special machines, like those used for drawing foundry coke-ovens of the Semet-Solvay, Otto-Hoffmann, and similar types. There is, however, a marked difference between the chamber ovens for the manufacture of illuminating gas and coke-ovens, inasmuch as what is only a residual in one case is the chief product in the other. In foundry coke-ovens, distillation lasts from 36 to 48 hours, with a temperature of 1100° to 1250° C.; whereas in gas chamber ovens the time does not exceed 24 hours, and the temperature is lower. The conditions of distillation being thus somewhat different, the quality of the gas and coke is also varied. Gas coke is less compact than foundry coke, and sometimes it is difficult to discharge gas-retorts, whether by the pusher, as with those set horizontally, or by gravity, as in the case of vertical or inclined retorts. At the municipal gas-works at Padua, where there is a Klönne horizontal retort plant—the retorts being 20 feet long, 7 ft. 6 in. deep, and of an average width of 18 inches, each holding 4 metric tons of coal, which is carbonized in twenty-four hours—drawing has, at times, been a difficult matter; and it appears that similar trouble arises with vertical and inclined retorts.

Practical experience has demonstrated (1) that, in like circumstances as to the temperature of the retorts, the amount of coal dealt with, and the period of carbonization, some kinds of gas coal produce coke which is easily drawn, whereas others yield a coke which can only be removed by repeated applications of the pusher; (2) that with such coal all trouble diminishes and finally ceases by prolonging the distillation period from 24 to 48 hours; and (3) that difficulty is also experienced with some kinds of coal when the heating of the chambers is not uniform. These facts lead one to suppose that there are factors in the constitution of the coal which play a part in the production of coke which is difficult to draw.

Nature of the Experiments.

The author was able to carry out his investigations, comparing his experimental results continually with those obtained in the Padua Gas-Works; and he expresses his thanks to all who endeavoured to facilitate his researches—more especially the Works Manager, Dott. G. La Spada. The experiments were made with samples taken from the various deliveries of coal already on the works, or from cargoes which had arrived since January, 1911. The coal was New Pelton (Holmside) or Boldon—all being consequently from the Durham coalfield. On each delivery or when first each fresh lot of coal was used, a sample was analyzed; care being taken never to change the conditions of work in the analysis so as to obtain, as far as possible, comparable data. The results are given in the following table; the samples marked with an asterisk, especially Nos. 4, 5, and 6, being those producing coke which caused trouble in drawing. The figures all relate to coal dried at 90° to 95° C.

Table I.—*English Coal.*

	Coke. Per Cent.	Ash. Per Cent.	Volatile Matter. Per Cent.
1*.—New Pelton (Holmside), in works since the end of 1909; sample taken at the close of October, 1911	65·05	4·90	30 05
2*.—Do., in works since May, 1910; sample taken in April, 1911	64·80	3·70	31·50
3. —Do., arrived October, 1910; sample taken May, 1911	67·61	2·89	29·50
4*.—Do., arrived Jan. 15, 1911; sample taken during unloading	61·92	8·08	30·00
5*.—Do., arrived Jan. 21, 1911; sample taken during unloading	60·15	10·60	29·45
6*.—Do., do., sample taken as before	59·62	12·48	28·90
7. —Boldon, sample taken on arrival, June 1, 1911	62 80	6·40	30·80
8. —Do., sample taken on arrival, June 23, 1911	63·38	4·42	32·20
9*.—Do., sample taken on arrival, Oct. 27, 1911	60·63	9·92	30·45
10.—Do., sample taken on arrival, Oct. 27, 1911	67·90	2·85	30·25

The quantity of ash was determined by calcining, in a muffle, from 4 to 5 grammes of finely crushed coal in a flat porcelain capsule. For the yield in coke the author employed the American method, which gives the results most comparable with those obtained in working.

The investigations were then continued (by way of check) with samples of coal from Westphalia, Upper Silesia, and the Saar basin; samples Nos. 22 and 23 being sent to the author by Herr Weiss, the Manager of the Zurich Municipal Gas-Works.

Table II.—*German Coal.*

	Coke. Per Cent.	Ash. Per Cent.	Volatile Matter. Per Cent.
Oberschlesien			
11.—Castellengo	60·35	1·10	38·55
12.—Pochammer	62·70	2 07	35·23
13.—Borsigwerk	64·15	3·35	32·35
14.—Wolfgang	65·42	0·93	34·65
15.—Deutschland	64·32	1·18	34·50
16.—Brandenburg	61·84	3·16	35·00
17.—Minister Achenbach.	68·05	3·05	28·90
Westphalia			
18.—Recklinghausen II.	65·33	5·91	29·76
19.—Consolidation	64·09	4·34	31·57
20.—Shamrock	66·00	2·90	31 10
21.—Unserfritz	63·90	5·04	31·06
Saar			
22.—Brefeld	66·78	1·20	32·02
23.—Maybach	64·45	6·22	29·33
24.—Maybach	66·50	3·50	30·20

Having thus collected a sufficient number of samples of coal, the author made a series of comparative experiments to ascertain the possibility of finding different chemical properties or action in the samples marked with an asterisk in Table I. (Nos. 1, 2, 4, 5, 6, and 9) from those met with in the other samples. In the first place, the analytical results given show that samples Nos. 4, 5, 6, and 9 yield a high percentage of ash (more than 6 per cent.); samples Nos. 1 and 2, with a normal percentage of ash, had been lying at the works for a long time—for two years in the case of No. 1, and for one year in that of No. 2—in the open air, as there was no covered shed in existence at the time.

Yield of Volatile and Liquid Matter.

The author wished to determine, with a number of the specified samples, first of all the yield in volatile and liquid matter at the ordinary temperature. In Table III. are given results obtained by carbonizing 10 grammes of coal in a platinum retort connected with a glass (U) tube filled with glass wool and placed in an ice refrigerator. The gas produced after passing through the tube and a glass column filled with Laming purifying material, entered a meter, and was finally drawn out by a pump with a head of water; the pump being regulated so as to give a very slight suction inside the apparatus. The coal was distilled by heating the platinum retort, coated with a jacket of asbestos, by means of a large Méker burner; heating being continued for twenty minutes from the commencement of the issue of the volatile products. This was more than sufficient time to attain the average yield given in ordinary working. The U-tube was weighed before and after distillation; the amount of tarry matter mixed with the ammoniacal liquor being estimated by difference. The volume of gas produced was read on the meter; and the reading was corrected for temperature and barometric pressure. These determinations were made with all the English coal mentioned in Table I.; and the following figures are the averages of three determinations.

Table III.

	Liquid Substance.	Gas.
1.—New Pelton (Holmside).	13·5 grammes p. ct.	298 litres p. ct.
2 ,, ,, ,,	14·0 ,, ,,	311 ,, ,,
3 ,, ,, ,,	13·9 ,, ,,	290 ,, ,,
4 ,, ,, ,,	13·1 ,, ,,	314 ,, ,,
5 ,, ,, ,,	12·4 ,, ,,	310 ,, ,,
6 ,, ,, ,,	10·9 ,, ,,	305 ,, ,,
7.—Boldon.	14·6 ,, ,,	312 ,, ,,
8 ,,	14·7 ,, ,,	320 ,, ,,
9 ,,	15·0 ,, ,,	308 ,, ,,
10 ,,	14·2 ,, ,,	310 ,, ,,

The figures thus obtained, like those in Table I., do not show sufficient marked differences between one sample and another to lead one to suppose that the amount of volatile matter, liquid or gaseous, produced in the course of carbonization can have any influence on the coke.

Increase in Volume during Carbonization.

The author next investigated the increase in volume of coal during carbonization. To explain the difficulty experienced in drawing retorts, he says the idea immediately suggests itself of the possible increase in volume during gasification. This phenomenon is invariably met with in the distillation of gas coal; and in determining the percentage of volatile matter in a platinum crucible, it is always found that the coke, more or less compact, occupies a much greater volume than that of one gramme of the coal weighed. This increase is not proportional to the quantity of volatile matter emitted during distillation; and the dry coal, with

long flame, having from 40 to 50 per cent. of volatile matter, yields, as is known, a pulverulent or scarcely adhesive coke. The author says it should be borne in mind that the conditions of gasification on a working scale—more especially in the system to which he is referring—are totally different from, and not to be compared with, those observed when coking a gramme of coal. Both in chambers and retorts of large capacity, the coal almost completely fills the space; and increase in volume can only cause greater congestion of the coke, which is denser and more compact.

From the appearance of the coke obtained during the various experiments, of which the results are given in Table I., the author was able to note at once that the samples not marked with an asterisk yielded a much more voluminous coke than that obtained from the others; and when the experiments were repeated in larger crucibles with greater quantities of coal, the results were perfectly concordant. He also endeavoured to determine the density of the coke produced by distillation in a perfectly filled crucible; but the figures obtained by repeating the experiments several times with the same coal agreed but little with each other; and the averages were very different from those for gas-works coke.

Fragility of Coke.

In the author's attempts to make tests of the fragility of coke, by breaking up the lumps to determine the density, he was able to note roughly that the degree of fragility increases with the percentage of ash. To determine approximately the fragility of coke produced by distillation in a filled space, he carbonized each sample of coal in a porcelain crucible enclosed in a Méker furnace. The crucible was completely filled with coal, and covered with a round fire-clay lid secured by the cover of the furnace so as to prevent the lid being raised by the swelling of the coal during distillation. Each experiment lasted thirty minutes. The results were very far from representing absolute values; but the author says they certainly have a relative value, as they were always obtained in identical conditions. To get concordant results, it was necessary to bestow great care on the preparation of the sample of coal, which must have a uniform degree of fineness. The author always employed coal crushed to pass through a screen with meshes 2 mm. (0·08 inch) in diameter, but not greater. The averages of numerous experiments are given in Tables IV. and V.

Table IV.—*English Coal.*

Origin. [See Table I.]	Ash. Per Cent.	Resistance. Kilos.
1.—New Pelton (Holmside)	4·90	3·5
2. ,, ,, ,,	3·70	3·9
3. ,, ,, ,,	2·89	5·2
4. ,, ,, ,,	8·08	3·7
5. ,, ,, ,,	10·60	2·5
6. ,, ,, ,,	12·48	2·6
7.—Boldon	6·40	4·4
8. ,,	4·42	4·8
9. ,,	9·92	3·5
10. ,,	2·85	5·2

Table V.—*German Coal.*

Origin. [See Table II.]	Ash. Per Cent.	Resistance. Kilos.
11.—Oberschlesien	1·10	6·9
12. ,,	2·07	6·0
13. ,,	3·35	5·0
14. ,,	0·93	5·8
15. ,,	1·18	6·2
16. ,,	3·16	6·0
17.—Westphalia	3·05	4·9
18. ,,	5·91	4·0
19. ,,	4·34	4·2
20. ,,	2·90	5·1
21. ,,	5·04	4·3
22.—Saar	1·20	5·5
23. ,,	6·22	4·0
24. ,,	3·30	4·8

Repeating the experiments with much more finely crushed coal, considerably higher figures were arrived at. By crushing the coal carefully, so that it would pass through a screen with 360 meshes per square centimetre, the author obtained samples Nos. 5 and 6, which in the previously described conditions had yielded a more fragile coke.

Sig. Meneghini is of opinion that the difficulty which occurs in drawing retorts—whether this is done by hand, by machine, or by gravity—is due to the fragility of the coke. In the first case, on the contact of the piston of the pusher with the coke, or after displacement of the block has commenced, the coke crumbles and falls to pieces. There is then no longer a homogeneous consistent compressed block to be pushed out, but a mass of fragments which, under continued pressure, will break up into still smaller pieces, so that the pressure of the piston will not be exerted solely as directed. It is just the same in the case of plant in which the coke is drawn by gravity. When the block begins to descend, it breaks up, and movement is checked.

It has been noted in gas-works that the smaller the pieces of coal rich in ash the less is the difficulty in drawing the retorts—the coke being more uniformly compact. The greater or less uniformity of heating the retort also affects the fragility of the coke. Unequal heating of the sides of the retorts obviously results in a less compact, and consequently more fragile, block of coke. The author does not think too much attention should be given to the chemical composition of the mineral substances, nor that determination of the fusibility of the ash, which when fused might act as cement, would be of any practical utility.

Deterioration of Exposed Coal.

The author next proceeds to explain the fragility of the coke of samples of coals Nos. 1 and 2 in Table I., which, though not having a high percentage of ash, yielded a coke which caused some difficulty in drawing. This coal, as stated in the table, was for a long time on the works. As is well known, coal deteriorates when exposed to the air, and more or less rapidly loses its calorific power. This impoverishment is accompanied by decomposition in the constitution of the coal, which tends to produce a more fragile coke. This phenomenon, which may cause spontaneous combustion and destroy the coal, has been the object of many researches, and the causes which produce it are not yet clearly known. It appears to be chiefly the unsaturated compounds in the coal, which easily combine with oxygen and develop heat. With this increase of temperature there is a commencement of distillation, which leads to a pyrophoric condition. Repeating the experiments of W. Russell, recorded in the "Proceedings" of the Royal Society for 1908 [(B) Vol. LXXX., p. 376], the author succeeded in obtaining, by the simple superposition of fragments of coal, very distinct photographic impressions on plates—impressions which were explained by admitting a development of ozone on the surface of the slowly oxidizing coal. This phenomenon of spontaneous oxidation favours the formation of humic acid soluble in solutions of caustic alkali, and precipitated by hydrochloric acid. The author determined, with the coal previously described and three other samples from various places, the weight soluble, by prolonged boiling with a 10 per cent. solution of caustic potash; and he obtained figures varying from 0·4 to 1 per cent. in weight of dry coal, which he says correspond approximately with the amount of humic acid.

He then endeavoured to produce and accelerate the phenomenon of oxidation by the following methods: Keeping the crushed coal (1) in a current of humid air and at a greater temperature than the surrounding one—70° to 80° C., (2) in humid air richly ozonized, and (3) in humid ozonized air at a temperature of 70° to 80° C. In all three cases the percentage of humic acid increased very distinctly with coal kept at a high temperature in a current of air rich in ozone, in which case there was also an appreciable decrease in the heating power of the coal, even when the experiment was only of short duration. The following table shows the percentage loss in weight by boiling with a 10 per cent. solution of caustic potash after the coal had undergone the treatment described:

Table VI.

Coal.	During 10 Days.	During 60 Hours.	During 48 Hours.
3.—Holmside	1·895	1·595	9·450
7.—Boldon	1·255	2·470	12·395
11.—Castellengo	0·995	1·500	17·270
13.—Borsigwerk	1·040	3·050	10·050
14.—Wolfgang	1·115	1·985	13·130
18.—Recklinghausen II.	2·094	3·955	8·800
20.—Shamrock	1·885	2·350	11·245
22.—Brefeld	1·550	2·750	18·050
23.—Maybach	0·980	1·900	20·670

By prolonging the action of temperature and ozone, the soluble amount in potash increases considerably until the solution has a colloidal appearance running turbid through a filter. Coal thus treated gives a coke the which is more pulverulent in proportion to the duration of the treatment. Crushing tests demonstrated that fragility considerably increases with oxidation. Coal No. 7, kept for twenty-four hours at 80° C. in a current of humid ozonized air, gave 12·395 per cent. of humic acid, and the coke was crushed with a pressure of only 1·8 kilos. Coal No. 14, with similar treatment, gave 13·130 per cent. of humic acid and a very friable coke with scarcely any adhesion.

The author remarks that these experiments, besides confirming the action which ozone existing in rain water can have upon damp coal, giving rise to spontaneous oxidation either of the coal itself or of the readily oxidized mineral elements it contains (pyrites, &c.), also confirm the formation of humic acid in the phenomenon of oxidation and lead us to consider the importance of the determination of humic acid in the coal to be carbonized in modern chamber retorts, in which fragility of the coke has no slight effect upon the facility of drawing. Technically, he considers as sufficient, in preference to the exact estimation (which is not easy) of humic acid, a determination of the loss of weight by treatment with caustic alkali; and he suggests the following process, which he employed in the experiments described. Finely crushed coal, 2 to 3 grammes, is desiccated in a current of inert gas ($N_2CO_2H_2$), accurately weighed in a tared filter, and then poured into a beaker containing some cubic centimetres of alcohol. About 50 cubic centimetres of a 10 per cent. solution of caustic potash are added, and all boiled for half-an-hour, closing the beaker with a Soxhlet refrigerating stopper. Alcohol is added to prevent the coal floating on the potash and forming a heavy scum. After cooling, all is filtered by decantation, twice treating it, and again boiling with 50 c.c. of the potash solution in a Gooch crucible previously tared in a glass weigher. After collecting all the coal in the crucible, and washing it with boiling water, alcohol, and ether, the filter is dried in a current of inert gas, and again weighed closed in the filter-weigher. Good recently-mined gas coal does not generally contain more than 1 per cent. of matter soluble in alkali. When this limit is exceeded, it signifies that

decomposition has commenced, and consequently that the coal must be regarded as suspicious from the point of view of spontaneous combustion and fragility of coke.

Conclusions.

Summing up the results of his investigations, the author says it seems to him that the great importance of the fragility of the coke in the modern systems for manufacture of lighting gas has been sufficiently demonstrated. Fragility, considering the relatively brief duration of distillation, is, he points out, increased by the mineral substances in the coal; and their action is greater the less uniformly they are distributed in the coal. By simply prolonging distillation beyond the usual time (twenty-four hours), these substances can act as cement, because then only is a sufficiently high temperature attained in the retorts, according to the experiments of Herr Hilgenstock.

The spontaneous decomposition of coal exposed to the air for a long time also causes fragility. Consequently, determination of the percentage of ash in the coal should not be neglected in gas-works with the new types of plant, chamber retorts, and retorts of large capacity. Nor should the analysis of humic acid be neglected to detect the decomposition produced in the coal by slow spontaneous oxidation, which contributes to produce more fragile coke.

NATURAL GAS AND ITS USES.

The last two numbers of the "Journal of the Franklin Institute" have contained an illustrated paper by Mr. I. N. Knapp, on "Natural Gas, with Incidental Reference to Other Bitumens," which was presented at a meeting of the Mining and Metallurgy Section of the Institute early in the year. It is divided into ten sections; but only the two concluding ones are of special interest to "Journal" readers. Section IX. consists of the following expression of the views of the late Dr. Edward Orton on the proper use of natural gas; and in Section X. the author summarizes his paper. These sections are as follows.

The Proper Use of Natural Gas.

Natural gas is the best fuel known to man. No advance beyond it is possible; but to secure the best results some scientific knowledge is required in regulating its combustion. Since it is the perfect fuel, it admits of application to almost every purpose to which fuel can be turned. The principal exception is in the manufacture of iron from its ores and in other similar metallurgical processes. In the working of iron on rolling-mills, forges, and foundries, and in the production of steam for all its multifarious applications, in the direct use of heat, in the manufacture of glass and cement, in the burning of pottery, tile, and brick, it is, as before said, the perfect fuel. It effects important economies, and greatly improves the quality of production at the same time. But superlatives in describing its advantages and value ought to be reserved for its use as a household fuel. It is here that it does the greatest good to the greatest number. It lightens and simplifies the labours of house-keeping to a surprising extent.

The truth is that natural gas ought to be exclusively confined to domestic use. It is too good for any other line of service, too fine a product for the coarse applications already named. It is a profanation of the good gifts of Nature to use gas in burning bricks and tiles, in calcining limestones, in generating steam, in the manufacture of glass or cement. There is not enough of it anywhere for manufacturing purposes. The most prolific districts for its supply thus far known in the world have been exhausted in a single decade. The amount of gas required in manufacturing necessitates the speedy decline and failure of every gas field, even the greatest.

Iron working demands by far the most lavish and unwarrantable use of gas of all manufacturing industries. A rolling-mill will range from 1 million to 5 million cubic feet a day. How far will 1 million cubic feet go in the support of household use? A house of twelve rooms, using gas in cooking-range, laundry, furnace, and in six grates, consumes on an average for the year about 40,000 cubic feet a month, or 1333 feet a day. One million feet would supply 750 such establishments, or what the smallest rolling-mill would use in a day would serve such a home for more than two years. But instead of using 1333 cubic feet a day, the average residence will find all its necessities met by less than one-half the amount named; for 500 cubic feet will make an ample daily supply for the majority of city or village homes. For such use the amount consumed in the smallest rolling-mill in a day will serve 2000 ordinary residences for the same length of time, or would serve one such dwelling for 2000 days. A ten-pot window-glass factory uses what would supply 1200 dwellings for an equal length of time.

The sacrifice of human comfort and well-being to business greed finds a striking illustration here, and cannot be too emphatically condemned. The application of natural gas to manufacturing uses necessarily involves such a sacrifice. Whoever has occupied for a year a dwelling adequately supplied with natural gas will recognize so many and so great additions that it makes to the comfort of life, that he will not insist on a very close balance of expenditures and credits in dealing with this subject.

When applied to manufactures, it is doubtful whether natural gas works in the interests of the general good. It is true that the cost of manufacture is cheapened and the quality of the production is likely to be improved by its introduction. But the fortunate manufacturer who can avail himself of it at once begins to undersell his competitors who are working under the old conditions, because his fuel, which is often the most costly element in his business, costs him nothing. In this way the most prudent manufacturer carrying on his business in the old way may find himself forced to the wall. Competition for him is simply impossible till the storm is past. Meanwhile the manufacturer who uses natural gas finds his business greatly improved in volume for the time being, because of the discouragement and failure of his natural competitors.

Such a state of things is not good for any community. It is much worse when the towns that find gas within their reach invite manufacturers by municipal grants and the like. Factories come to be established far from all supplies of essential materials with the one exception of fuel. As soon as fuel fails, the factory is bound to disappear. In many such cases the last state of the town is worse than the first.

One of the evil results of the use of natural gas in manufactures is the development of the speculative fever called a "boom" in the towns that find gas at hand. Real estate feels the effect soonest. Inflated values derange legitimate prices, and the reactions that are inevitable are always hurtful. The proper use of natural gas —*i.e.*, household use—is the only one that can bring an adequate return to the company undertaking to supply it. It is a source of satisfaction to find that the true use pays best.

The price of gas ought to be increased in every community that is now using it. There is no good reason why it should be sold at any less price than the fuel which it displaces, or, in other words, why the better article should be sold for less than the inferior. In computing the cost of the displaced fuel, account should always be taken of the various items involved, such as its storage and preparation, the cost of lighting fires, and the expenses of removing ashes and cinders, none of which enter into the use of gaseous fuel. It may be urged that an increased price for gas would result in extravagant profit for the gas companies. It cannot be denied that there is a possibility of such a result; but, as a matter of fact, there are very few cases in the country in which companies have got back their original investment or see any good chance of getting it back. They are generally obliged to content themselves with generous dividends while the gas is in full flow.

Summary.

For ages the human race has known of natural gas through its surface indications; but the great storehouses of this best of Nature's fuels were unknown and unsuspected until about two generations ago, when by accident the drill of the brine and oil producer revealed their presence; and of the vast quantities of gas thus unlocked, the door was at first left wide open for its wasteful escape. Only forty years have passed since there was effort made to control and utilize this valuable fuel; and it has been too often regarded as a bye-product of the oil fields of no special value.

We have learned that porous rocks, under proper conditions, act as reservoirs or storehouses for oil and gas. When by force we break into them with the drill, we find the invisible and practically inodorous gaseous contents under great pressure, and so peculiarly elusive and migratory. If the drill hole be not well guarded, it will flee to other places, and, if left open to the air, will escape and be lost. It is largely because of these characteristics—invisibility and self-escape—that the amount lost is not appreciated. This mobile or migratory condition of oil and gas is reflected in legal decisions.

The Supreme Court of Oklahoma, in a recent decision, held that "oil and gas cannot be sold in the ground, but simply the right to use what comes to the surface. Coal and other minerals go with the ground, as they are part of it. But oil and gas, while of the earth, are not earth; and while oil land can be leased or sold, and the oil itself sold after it comes to the surface, it cannot be transformed until after it is out of the ground. The same rule applies to gas. If oil and gas were of such a nature they would remain in place like coal, we would not have such hard problems to solve in the production of oil, and particularly that of natural gas. After they are once discovered in paying quantity, it is impracticable, under present conditions, to hold them in the ground for a rise in value or for future use.

The general public have been very much misinformed as to the actual conditions surrounding the production and marketing of natural gas; and the statements of those who are in such positions that they ought to know the fundamental facts of the business unquestionably do the most harm. Let me quote a few gems

of the kind, false though they be; they occur where only the real article is expected to appear. The President of a Gas Association, in an address in 1906, spoke of natural gas as follows: "I believe by its judicious application and husbanding we will have an everlasting supply of this greatest of all fuels." The Director of a State Geological Survey said before a Gas Association in 1910: "We are trying to keep our gas at home. We need it. It is true, we have been wasting it about as fast as we could, but at the same time we do not want you all to take any of it away. What we do want is to locate factories here that will utilize our fuel. We have plenty and to spare. If the gas fields are ever exhausted, we have a few billion tons of coal to fall back on."

The most casual perusal of the publications of the United States Geological Survey would show that an "everlasting supply" is not to be expected, and that no field has "plenty and to spare." In contrast to these statements, I will venture to quote from the Preface of the Geological Survey of Ohio, 1890, as follows:

> The natural-gas interests of the State have demanded and received in this report a measure of attention that is out of proportion to their intrinsic value. These interests are in marked contrast with the oil interests of the new fields in this respect—viz., that, while the latter are almost exclusively in the hands of those whose knowledge has been derived from a varied and costly experience in the business, the former have been in many instances turned over to persons who have never seen a gas field aside from the particular one of which they are called upon to take charge. It is not surprising, under such circumstances, that crude and erroneous views in regard to the nature of the gas supply should find place among these companies and municipal boards, nor that a wasteful and extravagant policy in the use of the gas should be established or allowed by them. To convince such officials that gas is not being generated in the underlying rocks as fast as their wells are able to withdraw it—that is, strictly stored power—and that every foot taken from the reservoir leaves the amount remaining there so much the less, has been a difficult, and in some respects a thankless, task. Nature has, however, become the teacher of all these communities that have broken into her storehouses of force; and falling pressure and supply-pipes half filled have come even more speedily than was expected to convince all who are able to learn that high-pressure gas fields are always exhausted by use, and that, in fact, they begin to die the moment they begin to live.

It is strange how persistent the idea is that oil and gas are being generated in the underlying rocks as fast as wells are able to withdraw them. I once had the Governor of a great State tell me that oil in a certain field "was being formed right now" in such quantities that the "gushers would never give out," and that scientists had so informed him. . . .

Against the improper use and wanton waste of natural gas many have made earnest but unavailing protest, receiving often the curses instead of the thanks of those in whose interests they have laboured. To convince the most intelligent and fair-minded members of a community of the justice and wisdom of such views is an easy task; but, unfortunately, people of this kind are in a hopeless minority.

The highest and really the only proper use of natural gas is household use. In this field it meets the supreme test of doing the greatest good to the greatest number. If the world were wise, and if genuine goodwill controlled the actions of all, every foot of natural gas would be scrupulously saved for this service; but the world is not wise, and universal benevolence does not bear sway.

As a practical matter, the franchise rates for the domestic consumption of natural gas should be much higher. Manufactured gas is sold at $1 per 1000 cubic feet in many cities, and successfully competes with coal and wood for domestic cooking and lighting. Why should municipal authorities expect to get a better article for 30 c. or less, and bring about conditions that tend to its waste and improper use, when a higher price—say 50 c.—would prolong the use of the better article, and thus eventually save their citizens a much larger sum than using 25 c. gas a short time? Why howl about conservation, and try to force people to furnish an article at less than a fair cost, when such authorities have the means to bring about practical conservation, and give their citizens the comforts of natural gas for a long period of time and at a less total cost than to force cheap natural gas for a short time, and then get to manufactured gas at treble the price?

If the distributing companies get a remunerative price, so that they can make natural gas worth a cash price at the well so that there will be a profit to the well owner in saving gas, conservation of natural gas will automatically take place, as well as greater stability to the business.

The Dawsholm Gas-Works, Glasgow, will be visited next Saturday by members of the Scottish Junior Gas Association (Western District), who will inspect the installation of vertical retorts on Mr. Alex. Wilson's patented continuous-intermittent principle. The installation at Dawsholm will, when completed, comprise 144 retorts, capable of manufacturing 5 million cubic feet of gas per day. At present, only 72 retorts are completed and working; and they are making 2½ millions per day. The next ordinary meeting of the Association will be held in the Royal Technical College, Glasgow, on March 8, when Mr. George F. M'Killop, the Chief Assistant-Chemist to the Broxburn Oil Company, will read a paper on the "Vertical Retort of the Shale Oil Industry."

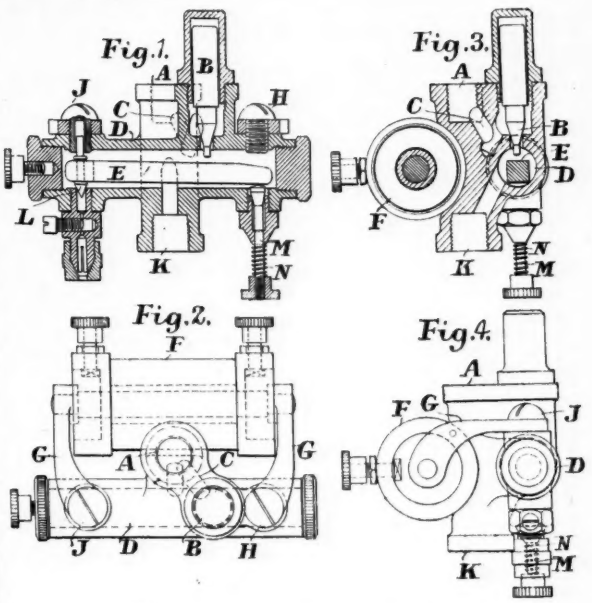
REGISTER OF PATENTS.

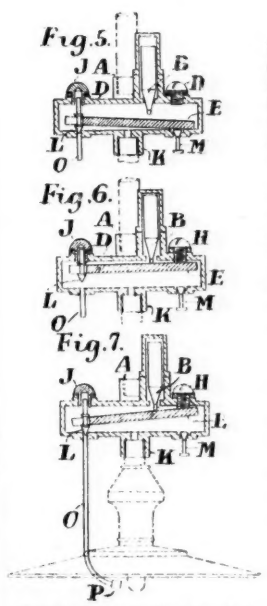
Electrically Operated Valve-Controlling Devices.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 6517; March 16, 1912.

This invention relates to electrically operated devices serving to control the operation of main and auxiliary valves for regulating the supply of gas to gas-lamps; and it consists primarily in the provision of a permanent magnet, constituted as a bodily movable or "floating" element, "having its poles located below pole pieces magnetized on excitation of the electro-magnet."





Keith's Electrically Operated Valve Device.

Fig. 1 is a longitudinal vertical section and fig. 2 is a plan of the devices. Fig. 3 is a vertical section at right angles to fig. 1; and fig. 4 is an end elevation. Figs. 5, 6, and 7 show the valves and operating devices in different operative positions.

The gas inlet connection A is near a vertical needle valve B (the main valve), to the upper side of which the gas passes by way of a port C. The valve passage opens into a horizontal tube D, in which is fitted loosely a permanent bar magnet E. Parallel with the tube D is a coil F, the ends of the core being extended by soft iron pieces G and iron screws H J, to constitute a horse-shoe magnet the poles of which terminate within the extremities of the tube. When an electric current is passed through the coil F in such a direction that the polarity of the two ends of the horse-shoe will be opposite to that of the adjacent ends of the permanent magnet, a powerful lifting force will be applied to the permanent magnet, which will be lifted bodily at both ends (as fig. 6), and in being lifted will knock the main valve B off its seat, so that gas can pass direct to the outlet K.

The permanent magnet E is slotted at the end adjacent to the screw J, and embraces the spindle of the auxiliary valve L, the upper portion of which spindle projects into a hole in the screw which serves as a guide. On being lifted, the end of the permanent magnet next to the screw H remains attached to it when the current is interrupted; but the end of the magnet next to the screw J does not adhere on the current being interrupted—a small brass flange on the auxiliary valve spindle preventing it making direct magnetic contact. On reversal of the current in the coil F, so as to make the poles J H of the horse-shoe magnet of the same polarity as the adjacent poles of the permanent magnet (but with a reduced current), the effect of the permanent magnet is neutralized, and it falls away—thus allowing the main valve B to close by gravity.

As shown in fig. 7, the auxiliary valve L is adapted to control the gas supply passing through a pipe connection O to a point adjacent the mantle of a gas-lamp—an electrically controlled ignition device being provided at P, if desired.

The cycle of operations is as follows: On depression of the "on" button, the permanent magnet E is lifted at both ends (as fig. 6), and opens the main valve B and the auxiliary valve L. On release of the "on" button, the end of the permanent magnet engaging the auxiliary

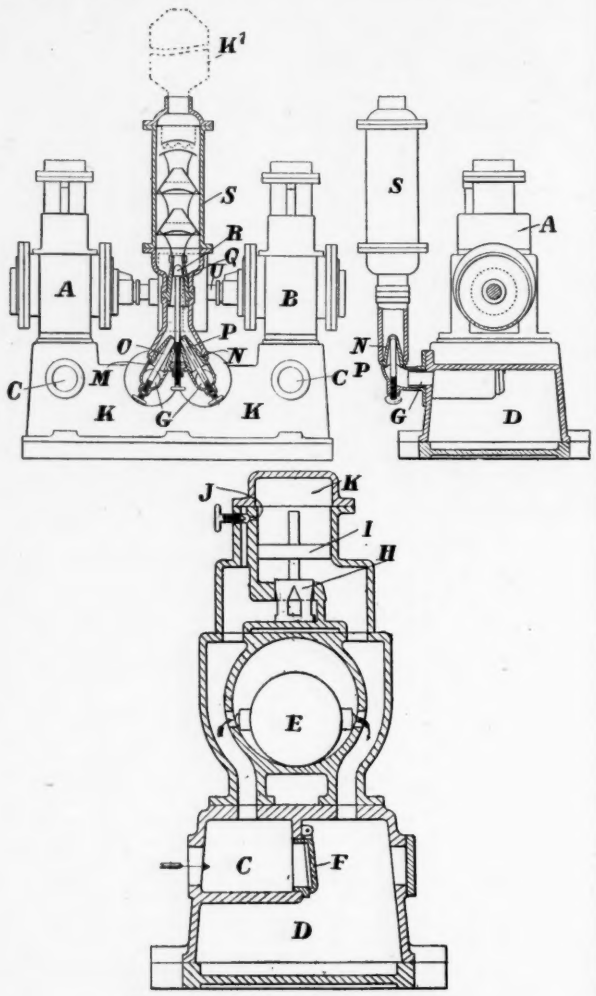
valve drops, but the other end remains up (as in fig. 7); thus closing the auxiliary valve L and leaving the main valve B open. On reversal of the current by pushing the "off" button, the other end of the permanent magnet E drops, and allows the main valve B to close (as in figs. 1 and 5). An independent manually controllable spindle M is provided, the upward movement of which lifts the permanent magnet and causes the main valve to be opened mechanically in case of any failure of the electrical device; the head of the spindle being formed as a valve which is normally held seated by a spring N.

Gas and Air Mixing Apparatus.

SIMCOCK, H., of Manchester.

No. 5194; March 1, 1912.

This gas and air mixing apparatus is for use in connection with lighting or heating installations, with the object of providing a simple but effective combination of parts for giving any desired proportion of high pressure gas and air.



Simcock's High-Pressure Gas Apparatus.

The illustrations are an elevation (partly in section) of the plant, an irregular cross section, and a sectional end elevation.

The pumps A B (of any suitable construction) are put in combination with high and low pressure reservoirs D C, both for air and gas—the pumps drawing the air and the gas from the low-pressure reservoir C and delivering it to the high-pressure reservoir D. Both reservoirs are formed in the pump base. The low pressure gas or air entering the reservoir C when the rotating piston E is not in action, opens the hanging valve F, and flows to the gas or air outlet; but when the piston rotates and raises the pressure in the compartment D, the valve F is held upon its seat, and high-pressure gas or air alone passes through the delivery passage. A piston type valve H is provided in the pump casing, having a piston I on its stem acted upon by the pressure at the high-pressure or pump delivery side. When the pressure exceeds a predetermined amount, the piston I lifts and opens the valve H, thus bye-passing some of the high-pressure gas and returning it to the low-pressure side. The action of the piston and piston valve is controlled by throttling the passage J leading from the upper side of the piston to the low-pressure side of the pump. If the passage is unduly restricted, the piston compresses the contents of the chamber K when it lifts. Its free movement is thus restrained.

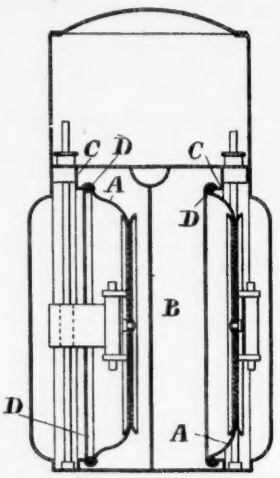
The gas and air from the high-pressure or pump delivery sides of the apparatus pass by the ports G in the base to the nozzles M N (one for air and one for gas) controlled by the valves O P. The two streams are projected against one another, and then travel to a conical nozzle G controlled by a valve R, which directs the jet at high velocity on to the baffles in the vessel S, so as to ensure the thorough mixing of the gas and air. A reservoir K^1 may be employed for providing a reserve of combustible mixture.

Dry Gas-Meters.

SUTHERLAND, J. G. & A. G., and IVERS, D., of Birmingham.

No. 3190; March 8, 1912.

This invention consists essentially in securing the edge of the diaphragm of a dry meter by means of a wire within a groove formed internally on a substantially rectangular frame.



Sutherland and Ivers' Dry Gas-Meter Diaphragms.

Each flexible diaphragm A is attached to the four interior sides of its surrounding chamber B by a rectangular metal frame C. Around its outer edge, the metal frame is secured to the sides of the case by soldering; and around its inner edge the frame is formed with a groove for the reception of the edges of the flexible diaphragm and a locking wire ring D adapted to spring into the groove and secure the edges of the diaphragm to the frame. The section of the frame is such that the grooved part is displaced laterally with respect to the edge which is soldered to the case. The soldering of the frame to the case can thus be effected after the diaphragm has been attached to the frame "without serious risk of burning the diaphragm."

Self-Correcting High-Pressure Gas-Meter.

MARSH, R. G., of Edgbaston, Birmingham.

No. 12,500; May 25, 1912.

This invention has for its object to enable the correction of registration, with varying pressures of gas passing through the meter, to be effected without the use of independent apparatus attached or connected to the index.

The principle of working, the patentee points out, is to make the correction in registration of the gas according to the pressure at which it is being passed through the meter, by automatically altering the cubic capacity of the measuring drum, so that at the lowest pressure at which the meter is required to work, the drum is at its maximum capacity, and at the highest pressure the capacity of the drum is at its minimum. For a given number of revolutions of the drum the movement of the index wheels driven thereby is constant, but for a given volume of gas at low pressure the number of revolutions of the drum is less than when passing an equal volume of gas at high pressure. By controlling the cubic capacity of the drum by the pressure, the percentage necessary to correct the registration to any desired pressure is thus added uniformly and in constant ratio.

The meter drum is arranged to rise and fall so that, under increased pressure of the gas, the capacity of its measuring chambers is correspondingly reduced. To this end, nearly the whole weight of the drum and its frame when submerged may be supported by floats which are not sufficient to lift the drum when the meter is filled with water in the usual way, and the balance of the weight is taken by floats supported in a heavier liquid than that used for filling the meter—mercury being preferred. The reservoir containing this heavier liquid communicates with a displacement chamber or tube which should be capable of containing a column of mercury corresponding to the maximum pressure at which the meter will be used. The bore or walls of this chamber or tube should have a relation to the curve showing the decrease of the capacity of the meter drum as the liquid line rises within it. This relation should be so adjusted that when, owing to an increase of pressure, a certain amount of mercury is expelled from the reservoir the fall of the mercury level will be sufficient to lower the meter drum to an amount which will reduce its capacity by the correct percentage. The adjustment of the bore of the displacement chamber enables this result to be obtained.

Fig. 1 is a general sectional view of a high-pressure gas-meter. Fig. 2 is a sectional view of the displacement chamber. Fig. 3 is a detail view of the gas-pipe or spout and its connection to the cradle or carrier frame. Fig. 4 shows the gear connection from the drum spindle to the index spindle. Fig. 5 is a plan of it.

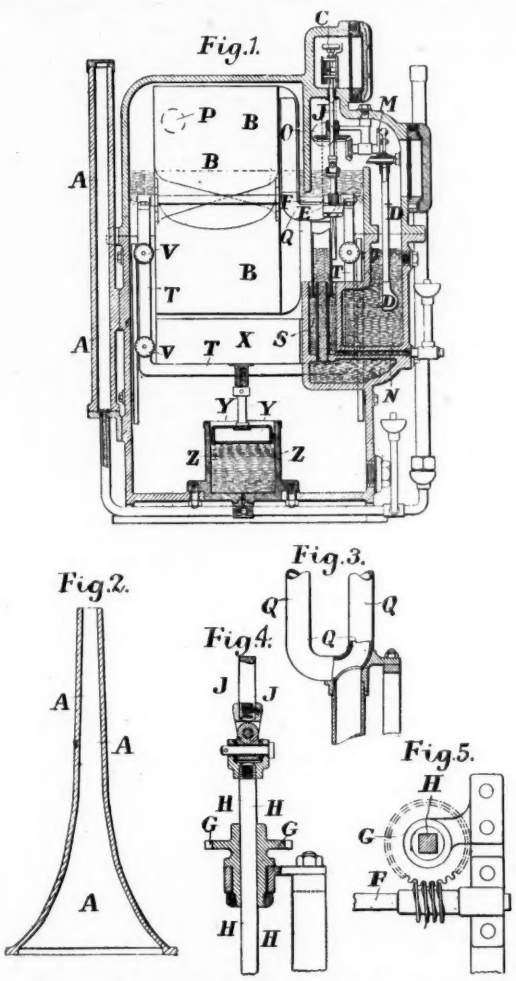
The driving connection between the drum B and the index C comprises a worm E on the drum spindle F driving a worm wheel G on a spindle H. The relation of the wheel G to this spindle must allow for the wheel travelling up and down on the spindle. This is connected by a universal joint with the index driving spindle J. The compensator D is operated from the spindle by bevels and a crank M, and through a connecting rod to an arm on the compensator spoon, so that this is rocked as the crank rotates and raises water from the waste-water box N.

The gas inlet O is separated from the main chamber, in which the

drum revolves, by a screen wall dipping into the liquid seal. The gas is led from this inlet chamber into the drum by a U-pipe Q, and is discharged under the hood of the drum. From the pipe Q is a liquid drain pipe, sealed preferably by a mercury seal S, so as to convey any liquid condensing in the U-pipe away into the waste-water box and prevent blocking of the pipe. The U-pipe must be so arranged that its ends are always above the liquid line within the meter.

The gas passes through the portion of the drum which is not submerged, and revolves the drum by its action on the drum vanes on its way to the outlet P in the usual manner.

To enable the presence of the gas to adjust the capacity of the measuring chambers of the drum and correct the registration according to the pressure (on the principle already explained), the drum is arranged for vertical movement, and to this end must be guided so as to maintain the driving connection from it to the index. In the arrangement shown, the drum B, with its spindle, is mounted in bearings in a frame or cradle T, arranged to travel on vertical tracks on the walls of the main chamber, by such means as runners V. The pipe Q obviously must move with the drum, and is therefore mounted on the frame or cradle by lugs secured to the frame. The worm wheel G must also travel with the drum so as to remain in mesh with the worm E; and this is the purpose of the provision of the length of square or equivalent spindle H. To enable the wheel to travel up and down this spindle, it is mounted in bearing, also carried by the frame or cradle;



Marsh's Self-Correcting High-Pressure Gas-Meter.

and it thus moves exactly in correspondence with the worm on the drum spindle, and a driving relation is always maintained.

The drum and the frame are mainly supported by floats X in the sealing liquid of the main chamber of the meter.

To ensure the correct rise and fall of the drum to make the correction for the pressure of the gas, a float Y takes the balance of the weight of the drum and frame. It is supported on a heavier liquid than that within the meter (preferably mercury), and may thus conveniently be arranged in a pot or vessel Z in the bottom of the main liquid chamber; and the float Y may be connected directly with the drum frame or the main float as shown. In the example given, the passage from the pot Z communicates with two tubes, one of which communicates with a filling cup and may also lead to a tube which forms a mercurial gauge; while the other tube communicates with a displacement chamber or tube A. The chamber is here shown outside the meter, but may be formed within it if desired. It should be capable of containing a column of mercury corresponding to the highest pressure at which the meter will be used; and the bore or walls of the chamber should bear a relation to the curve showing the decrease of the capacity of the drum as it is depressed within the sealing liquid.

With this construction, when, owing to an increase of pressure of the gas, a certain amount of mercury is expelled from the pot, the amount of mercury which is accommodated by the shaped displacement chamber will ensure the level of the mercury in the pot falling to what is necessary to lower the meter drum, so that the capacity of its available passage—*i.e.*, the measuring chambers—is reduced to make the proper correction for the additional pressure.

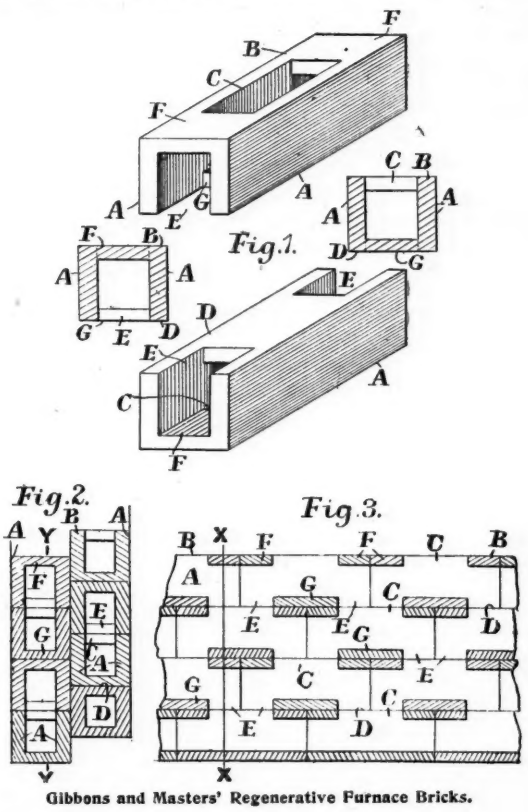
Gas and Air Passages of Regenerative Furnaces.

GIBBONS, W. P. & G. B. A., and MASTERS, E., of Lower Gornal and Westminster.

No. 6847; March 20, 1912.

Heretofore, the patentees remark, various forms of bricks have been used for the construction of gas and air passages of regenerative furnaces with the view of making the divisional walls thin, so that the waste gases of the down flue will be near to the rising air in the air flue and also to form struts or cross tiles to support the side walls and to baffle the air and gas passing through the flues and serve to transmit the heat from flue to flue. Some examples of these bricks and scotched or cross tiles are described in patents No. 16,256 of 1900 and No. 21,643 of 1908. A tubular tile has also been proposed divided into three longitudinal passages—the centre passage being for the waste gases, and the two side passages for the air. The centre portion of the tile was furnished with longitudinal slits communicating with the centre passage, and so arranged that the slits in the top of the tile were staggered relatively to the slits in the bottom of the tile, whereby a baffling effect was produced when the tiles were built up to form the flue.

According to the present invention, a tubular brick for use in building gas passages or air passages of regenerative furnaces is of square or rectangular shape in end view, is constructed with a single longitudinal passage, and has portions of its top and bottom walls cut away to form spaces for the passage of the air or gas and to leave struts which connect the side walls of the bricks.



Gibbons and Masters' Regenerative Furnace Bricks.

Fig. 1 is an outside view of a brick according to this invention; also an inverted view and transverse sectional views through the middle and end. Fig. 2 is a cross sectional view showing the bricks built into the form of flues—the section being taken on line X of fig. 3, which is a sectional elevation on the line Y of fig. 2.

The bricks are of tubular formation and of square or rectangular shape viewed from the end—being adapted to be laid together end to end in courses, so that the side walls A of the bricks form the side walls of the flues. The top wall B of the brick is cut away at about its middle, so as to form an opening C, which communicates with the interior of the brick; while the ends of the floor D are cut away at E to leave apertures which also communicate with the interior of the brick, without diminishing the thickness of the side walls. Thus the side walls are connected at the top by two end parts F and at the bottom by a middle part G, in such a way that they form the necessary struts to support the side walls and transmit heat thereto. The middle part is of the same width as the two end parts together. The portions of the top and floor of the brick are so cut away that when the various courses are laid, the solid portions which form the struts in the various courses will be staggered, as shown in fig. 3, and the required baffling effect is thus obtained.

The Gas Committee of the Bradford Corporation have given instructions to the Engineer, Mr. Charles Wood, to submit a report upon the question of extending the manufacturing and purifying plant in order to meet the increasing demand for gas.

LEGAL INTELLIGENCE.

THE NATURAL GAS AND PETROLEUM CIRCULARS.

Fines Imposed on the Printers and their Employers.

At the Tower Bridge Police Court on Friday, Mr. Gill gave his decision on the summons against the Leadenhall Press, Limited, for printing certain booklets and circulars without imprint and for publishing and dispersing (or assisting to disperse) them, and against Edmund Eaton, Colonel the Hon. Hubert Duncombe, D.S.O., and Daniel Wallace Heims for aiding, abetting, counselling, and procuring the printing, publishing, and dispersing of the documents. The previous proceedings have been reported in the "JOURNAL." [*ante*, pp. 116, 197, 332.]

Mr. GILL, in giving his decision, said in his opinion the evidence showed that both Heims and Eaton were concerned in procuring the printing of the documents in question. They were both in communication with the Leadenhall Press; the letters and the evidence of Mears showed that the proofs passed through the hands of Heims; and Eaton provided the blocks for illustrating the booklet and corrected under his own hand the circular. The booklets and circular-letters when printed were delivered at 5, Abchurch Yard; and there Eaton employed the witness Marshall to enclose a large number of them in addressed envelopes. According to his statement to Mears, he was commissioned by the South of England Natural Gas and Petroleum Company to sell bonds, which doubtless were those referred to in the booklet and circular. Both Eaton and Heims took an active part in the distribution of the documents. Heims took 2500 of them to the post office for despatch, and Eaton, as sender, signed the paid-charge note. He (his Worship) could not doubt that Heims and Eaton both saw the proofs, and that they read them critically; and he thought the reasonable inference was that they knew the name and address of the printer was not upon them. They were both responsible for causing these proofs to be multiplied in the press, and therefore responsible for procuring the booklet and circular to be printed without the imprint. Incidentally, this prosecution had served a useful purpose by giving publicity to the denial that the distinguished names—headed by that of Lord Fisher—which appeared on the front page of the booklet had any connection whatever with the South of England Natural Gas and Petroleum Company. That the manner in which this list was printed was most objectionable could not be doubted and had not been disputed.

Mr. BRIGGS, who appeared for the Public Prosecutor, intimated that he desired to call evidence as to Eaton's character.

Mr. GILL presumed that Counsel for the Crown was acting on good sense of authority and that the evidence would not be disputed.

Detective-Inspector *Fowler* said that his inquiries showed that for a number of years Eaton had been associated with the formation of a large number of companies, and he had been referred to in financial papers——

Mr. HARNEY raised an objection to this evidence, and submitted that, although the Magistrate might have been entitled to find that Eaton and Heims knew that the imprint was missing, there was no evidence that they were aware that the omission was a breach of the Act. They were accidental and not wilful offenders. They had no intention of doing anything wrong; and no serious consequences had resulted from the breach, because had the imprint been on the document the authorities would have been no nearer identifying the parties than in fact they had been by the document itself.

After some further argument,

Mr. GILL imposed penalties amounting, with costs, to £10 15s. in the case of the Leadenhall Press and in the case of Eaton and Heims to £27 6s. each.

On the application of Mr. Harney, his Worship intimated his readiness to state a case.

Referring to the case on Saturday, the "Financial News" said: "The Eaton gang, some of whom are concerned in this affair, have been concerned in the flotation of rubbishy gas companies for the last five years. The files of 'The Financial News' teem with cautions against the numerous ramps which various members of the gang have been responsible for. No libel action has ever been brought, or is ever likely to be. It is time that the authorities went further into the exploits of Eaton and his satellites."

INTERESTING DECISION ON CONTRACT LAW.

Non-Delivery of Gas Coal.

A preliminary judgment has been issued by Sheriff Shennan in an action raised in the Hamilton Sheriff Court, at the instance of Messrs. Alexander Russell and Co., coal contractors and exporters, of Glasgow, against the Provost, Magistrates, and Councillors of Hamilton for payment of £187 15s., the price of coal supplied under contract during the months of September and October, 1912, for use in the gas-works. The Town Council, while admitting that the amount sued for was due, pleaded that the pursuers had broken their contract, and that the Council were entitled to be compensated for the loss and damage sustained, and to recover from the pursuers the excess price for coal already purchased, or which is intended to be purchased, against the contract; also for the loss incurred through the use of inferior coal. This loss the Council estimated at £508, for which sum a counterclaim was lodged.

The contract was for the delivery of 10,000 tons of cannel coal over the period of eighteen months ending Nov. 15, 1912, in such quantities per month as might from time to time be ordered by the Gas Manager. The Town Council alleged that the pursuers failed to complete their contract by upwards of 2000 tons (though they had been repeatedly requested to make deliveries), with the result that the Council had to purchase coal from other sources at an increased price. The defenders further stated that it was "use and wont" for coal contractors to deliver coal to such places as gas-works after the expiration of the contract period. In reply, Messrs. Russell averred that the defenders' Gas Manager failed to give directions during the currency of the contract as to the monthly quantities of coal required, and that they are not bound to make deliveries after the expiration of the contract period. They replied further that the counterclaim should be disallowed as a set-off against the claim.

Having heard a debate on the relevancy of the action, Sheriff Shennan decided that the defenders' counterclaim was competently stated, but that they had not relevantly averred any trade custom qualifying the provision in the contract respecting the period within which delivery was to be made. His Lordship allowed a proof of the averments in support of the defenders' counterclaim and of the pursuers' answers thereto. Dealing with the question of the relevancy of the action, the Sheriff, in a note, stated that the defence was one which had always been recognized as competent against an action founded on contract. It proceeded on the well-recognized principle that a party who sues on a contract must come into Court with clean hands. It was a complete answer to an action for the contract price for the defender to prove that the pursuer had broken his contract; for no party was allowed to found upon a contract which he had broken. In the present case, the defenders made a perfectly relevant averment regarding the manner in which the pursuers had broken their contract. As at present advised, he doubted how far the defenders could claim in respect of purchases to be made after the expiration of the contract. Accordingly, his present view was that if any damages were due they must be calculated on the market prices ruling at periods of delivery not later than Nov. 15, 1912. Regarding the defenders' plea as to "use and wont," his Lordship said it did not matter what other contractors might have done, or what the pursuers themselves might have done on former occasions. The defenders must aver that, in the knowledge of both parties, the provision for delivery by Nov. 15, 1912, meant that any portion not then delivered would be supplied within a reasonable time thereafter; and defenders' averments come very far short of this.

Fraudulent Abstraction of Gas.

There were charges against Samuel Adair, of Belfast, at the Summons Court in that city, for laying a pipe to communicate with a gas-pipe in his mother's house without the permission of the Corporation, stealing and abstracting gas, and preventing a meter from registering the quantity of gas supplied. Defendant was an employee of the Gas Department, and had access to fittings, some of which he took and attached to the service-pipe, so that gas was prevented from passing through the meter, and was used without being paid for. The fittings could be removed, and the joints made correct before an inspector visited the house. The defence was that Adair was experimenting with the appliances; but a plea of guilty was entered. Sir A. Newton-Brady, R.M., who presided, said the Court convicted on only one summons, having regard to the plea; but the charges were of a very serious character—especially as Adair had signally failed in his duty as a Corporation employee. They must impose the substantial penalty of £4, with costs. A summons against Adair's mother, as tenant of the house, was withdrawn; it being urged on her behalf that she did not know her son was doing anything wrong.

Newry Gas-Works Management.

A rather heated discussion took place at a meeting of the Newry Urban Council, on a motion by Dr. Kean, J.P., to rescind a resolution appointing the Gas Committee for the year, and to re-appoint the Committee with the same membership as last year. Five members of last year's Committee who had voted for the appointment of Mr. O'Reilly, of Strabane, as Gas Manager, had been removed at the Council's annual meeting, and two retained; and Dr. Kean held that it was unfair to "victimize" three, while the majority of the Committee were wholly responsible for the appointment. Mr. Willis objected, on the ground that the old Committee had refused to give a reason for the appointment; and if the Council condoned this, future appointments might be made without inquiry as to qualifications. Mr. Ruddy said only three voted against Mr. O'Reilly, out of a membership of eleven. Mr. O'Rorke (Chairman of the Gas Committee last year) expressed satisfaction with Mr. O'Reilly; stating that less coal was being used now, and that the production of gas was greater. On a division, there were eight for Dr. Kean's motion and eight against; and the Chairman declared the motion to have failed—a two-thirds majority being required to carry it. Mr. O'Rorke and Mr. J. T. Cardwell then resigned their membership of the Committee, and the resignations were accepted.

West Surrey Water Company.—At the half-yearly meeting of this Company last Tuesday, under the presidency of Mr. Arthur Telford Simpson, the Directors reported that the income for the six months ended Dec. 31, after making provision for empty houses, irrecoverable rates, &c., amounted to £8773, and the expenditure to £3371. There were 918 yards of pipes laid for the extension of service-mains, &c., and 88 additional supplies connected (in the half year), representing an increased future rental of £234 per annum. The Engineer and Manager (Mr. John K. Hill) reported that the whole of the works and plant were in good condition. The amount now available for distribution among the ordinary shareholders was £6566; and maximum dividends at the rate of 7 per cent. per annum were declared on the £10 shares issued under the Acts of 1877, 1888, and 1901; and a maximum dividend at the rate of 10 per cent. per annum on the ordinary £10 shares issued under the Act of 1869.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Wednesday, at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Mr. CHARLES CARPENTER, B.Sc., M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. F. M'Leod) having read the advertisement convening the meeting and the minutes of the last ordinary general meeting, the seal of the Company was affixed to the "Register of Proprietors."

THE CHAIRMAN'S SPEECH.

The CHAIRMAN: Ladies and Gentlemen,—The report having been printed and circulated among the shareholders, I presume you will, as usual, take it as read; and I now have the pleasure to move its adoption and the accompanying accounts.

THE HALF-YEAR'S WORKING.

Having regard to the happenings of 1912, I do not suppose any shareholder will be unprepared for the information that, from a financial standpoint, we have had a bad half year—certainly no other description can be applied to a balance of profit and loss which shows a deficiency of £31,727 on the six months' working. Now you have the right to hear this afternoon what the reasons are for this check to our prosperity, and how far its causes are likely to affect our operations in the future. The keynote of the explanation appears in the report as the phrase "the abnormal price of coal." Looking back over our records during the past twenty-five years, I can only find one occasion upon which the present figure has been equalled, and that was in 1900. Then, as in 1873, the great activity of the iron and steel trades stimulated demand to such an extent that requirements outstripped production, with the inevitable result that prices hardened to an extreme degree.

EFFECT OF HIGH COAL PRICES.

All industry suffers, as ourselves, from the extravagant cost of coal; and progress and extension of business are checked until this rights itself, because business cannot bear the burden of the heavy handicap. The price of 1900 fell in the following year 42 per cent.; and there is no reason why history should not again repeat itself. We do not know that it will, we only hope it will; and there is no reason why it should not. Our position in common with other like users is that we have to bear the burden of a trade boom after experiencing heavy losses by the great coal strike, when, as you will remember, we had to deplete our insurance fund to the extent of £75,000, and to pay for freightage from Canada and America more than double the price at which we had bought our coal in Great Britain. I may here remind you that the coal we buy is not in any way a manufactured article. It is certainly picked over before being put into the ships, so as partially to free it from the sulphur or "brasses" it contains. But with this exception it is the run of the mine; and just as it is hewn out of the seam, so it is loaded without screening or washing into the vessels which bring it to London. There is no waste, because the dust is practically as good for our purpose as the lumps. It is for this material that we are to-day asked to pay somewhere about 15s. per ton put on board ship in the North. This price is out of all proportion to the cost of production *plus* a fair profit; but it exists partly because of the demand for iron and steel, but mainly because nearly everybody seems struggling, both here and abroad, to replenish his depleted stocks, for which he is content to pay an extra cost which in the majority of instances he passes on to his customers. In the case of gas, there is a difficulty in doing this. First of all, 40 per cent. of our make of gas is sold to the less affluent, who, buying through slot meters, have to scrutinize carefully every pennyworth; and we should hesitate very seriously before raising the price of gas. For power and manufacturing users, the custom is increasing to sell by contract over a definite period, as few users would put down plant for power or industrial purposes unless they could be guaranteed costs with some degree of certainty (some users of oil-engines have been very badly hit through overlooking this precaution). For these reasons, therefore, among others, it is not practicable to pass on to our consumers the burden entailed by the high price of coal, as it is transferred in the case of the users of iron, steel, &c. It is a thousand pities that the Government did not adopt the course advocated by Sir Corbet Woodall of re-imposing a tax upon all coal exported out of the country until the needs of our many industries were satisfied.

NEED OF AN EXPORT TAX.

I need not remind you, too, that the late Sir George Livesey was a great believer in an export tax being levied upon coal (other than for bunkering ships) sent out of this country. I have never been able to understand why the tax was repealed. A member of the firm of one of the largest coal factors in the kingdom told me the export trade in coal would stand a tax up to 2s. 6d. a ton regularly imposed; but what would upset trade would be the uncertainty of its being levied or not. It seems inconceivably bad statesmanship that the foreigner should be able to buy freely our national store of raw material, without contributing a penny to the State which protects it, and to use it not only for his domestic purposes, but in competition with the British manufacturer.

VALUE OF RESIDUALS.

But for residuals, we should have had a much poorer account; and while endeavouring to obtain a good yield of gas, we have been very mindful of their importance in our balance-sheet. By careful attention to their quality, we are able to supply higher-grade articles than was at one time the case. Our make of coke, for instance, is now a standard one, and specified by buyers; while our tar and ammonia products are of the highest market quality, and command favourable prices on that account. The improvement in carbonizing which has been mentioned in earlier reports has had a favourable effect upon our tar products also. Benzol, for instance, is produced in double the quantity per ton of coal than was the case a few years ago. It has been rumoured that the Government intend to put a tax upon it; but it would be unfortunate were any steps taken to discourage the increasing production of home-made motor-spirit, which is becoming more and more one of our necessaries. The justification of the petrol-tax was to improve the roads of the kingdom; and I have heard no suggestion that the large revenue from it is insufficient for the Road Board's purpose. The use of tar for road-making affects us directly but little, though it is a great help to country works in obtaining a fair price for their make from local users. From all residuals, improved prices have been obtained; but it is, of course, out of the question to get advances proportionate to the increased charges by the collieries for the raw material. Such treatment would irretrievably damage our business. But the coal-owner and his miners have us at their mercy.

CHEMICAL MANUFACTURERS AND GAS COMPANIES.

Before leaving the subject of residuals, I must say a word about the recommendations of the Parliamentary Committee appointed in this connection. Bye-products have always been one of the inducements to trade in gas ever since its supply was first suggested. I came across the other day some proposals dated 1814 for the people of London to interest themselves in a company then formed. The inducement held out to them consisted in the value of the residuals—coke and tar—resulting from the distillation of coal. But the work of preparing for, and placing upon the market, the chemical products can rarely be done economically upon a small scale. Under various Acts of Parliament, however, we have perfect freedom to buy and sell our raw products from and to one another to our mutual advantage, and especially to the users of gas, because as you are aware, by far the largest proportion of any increased profits we make in our business goes into the pockets of the gas consumers, and not into those of the shareholders. This freedom was threatened by an attempt on the part of a combination of certain chemical manufacturers to abolish this accommodation—of course, with the view of diverting the trade into their own hands. It is certainly ours by right, as we have the burden of buying and handling the raw material; and, as we are content with reasonable profits shared with all our employees, any change would be most unwarrantable and unjustifiable. Many of you will remember that a Joint Committee of both Houses of Parliament sat last session to consider the attitude legislation should adopt with regard to gas undertakings making and dealing in residual products. I am glad to say that, as the outcome of their deliberations, they recommended that the manufacture of, and dealing in, gas residuals should continue, as now carried on in the great majority of cases, unrestrictedly. I cannot imagine any more suitable people than the gas undertakings themselves, when it is remembered that they are large producers of the raw products from which the residuals are worked up; and it certainly cannot be said that they pay inflated dividends, or that they are inconsiderate employers of labour.

NEW PURIFICATION PROCESS.

I must now devote a few minutes to paragraph 4 of the report. We already supply gas which, according to the official returns, has not only the highest lighting and heating value of any metropolitan supply, but is of the greatest purity. But we want to improve considerably upon the last standard. The shareholders in the Company have in the past been familiarized with the overwhelming objections to lime purification through the full details and information furnished at these meetings by my lamented predecessor; and the more we studied this process the more impossible did it become as a solution of the problem. To-day, however, we are in possession of the first fruits of our investigations which we have been pursuing for the last five years, and, as the report tells you, we are purifying under the new system the whole of the gas made at our Old Kent Road works. It does not yet completely satisfy all our requirements; but the improvements to be made are in details and not in principle, and are sufficiently understood to offer no hindrance to their adoption. I think I may say that our engineering staff sufficiently understand the difficulties to be able to obviate them. The plant works in an admirable manner, and it will fulfil all our expectations with regard to it. The first cost is high; but, with the improvements which we hope to effect, the cost of installation will be considerably reduced, which is not an unimportant matter. When this is done, we shall make and supply gas which has, I think I may say, never in the history of gas lighting been equalled for the purity which we shall attain.

EXTENDED USE OF GAS FOR LIGHTING, HEATING, AND COOKING.

With regard to the extended use of gas, progress in this direction has been satisfactory. We place more reliance upon a good service than upon advertisement for the extension of our business. In parade lighting, we have notable examples. Tradespeople now ask for these installations, finding that the sun-like radiance from high-power gas-lamps not only attracts customers to their shops, but affords them the right kind of light to enable them to select their purchases. So, too, is it with gas cookers and fires; their convenience and cleanliness lead to their recommendation by one consumer to another. The same is true of lighting appliances. The Company's show-rooms provide convenience for all requirements to be met; and we find they are increasingly patronized. The improvement in gas business we have experienced—it amounts to 6·21 per cent.—cannot, of course, be wholly put down to these causes. Climatic conditions come in also; and they have had a not unimportant share in contributing to the result. How far climatic conditions affect us, you can gauge from the fact that we have since Jan. 1 sent out no more gas than in the corresponding weeks of 1912; but the explanation is that we have had extremely mild weather, and our gas-heating appliances have not been brought into use, or only partially.

OUTLAY ON REPAIRS AND RENEWALS.

The cost of repairs and renewals has somewhat increased under all heads, and is mainly the result of making provision for the increased sales of gas. The charges are principally for labour in connection with works repair to plant for gas making and gas using. Thus the aggregate amount paid in wages is an increase of £19,000 (to £311,000)

paid in the half year. The work done is profitable; and we shall receive benefit therefrom in the future by the reduction of our costs.

CO-PARTNERS AND THE INSURANCE ACT.

Before I sit down, I must say a word about our workpeople. They tried hard, as you will remember, to obtain exemption from the National Insurance Act. They failed, and are now endeavouring to make the best job they can of it, though it has been, and is still, not an easy matter. One of the greatest hardships has been the case of men over 65 years of age, and of whom there are not a few, and who, though they pay their 4d., had no medical benefit allowed. Well, we could not let the old servants suffer through the hardships resulting from the Act; so we have arranged for the former medical officers of the Company to continue, at the Company's expense, the attendance they had hitherto given. One result of the Act has been to bring to what can only be described as an untimely end a relationship which has existed between the Company and its doctors for more than seventy years. I cannot let this occasion pass without publicly expressing our indebtedness for their unselfish devotion to the necessities of our workpeople, whose sufferings they have endeavoured to ameliorate, and whose healthfulness they have studied to improve by every means in their power, unstinting of time and trouble.

RETIRING DIRECTORS AND AUDITOR.

The only other matter dealt with in the report is the re-election of two Directors, who retire by rotation, and one Auditor. These will be dealt with by special resolutions after the adoption of the report. I should, however, take the opportunity of saying that the two gentlemen who retire are in the forefront of their respective professions, and their special knowledge has been of very great service indeed to the Board. I now formally move: "That the report and accounts now presented be received and adopted, and the report entered on the minutes."

The DEPUTY-CHAIRMAN (Mr. John Ewart) having seconded,

The CHAIRMAN said the report was open to discussion, and he should be very pleased to hear any remarks and to answer any questions which any shareholders desired to ask.

No questions were asked, and the resolution was formally put to the meeting and carried unanimously.

THE DIVIDEND.

The CHAIRMAN: I beg to move:

That a dividend at the rate of £5 9s. 4d. per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post.

Mr. JOSEPH NEWBOLD (an Employee-Director), on the invitation of the Chairman, seconded the motion, which was carried unanimously.

RE-ELECTION OF DIRECTORS AND AUDITOR.

The CHAIRMAN: I have now the pleasure to move that Mr. Kenneth Phipson Hawksley be re-elected a Director of the Company.

The DEPUTY-CHAIRMAN seconded, and the resolution was carried unanimously.

The CHAIRMAN: I have now the pleasure to move that Mr. Frank Harding Jones be re-elected a Director of the Company.

The DEPUTY-CHAIRMAN seconded, and the resolution was carried unanimously.

The CHAIRMAN: The next business is the re-election of an Auditor. This must come from your side of the table; and I will ask some shareholder to be good enough to move his re-election, and another shareholder to second it.

Mr. T. R. HILL formally moved that Mr. Thomas Spooner Soden be re-elected an Auditor.

Mr. W. EDGAR seconded the resolution, which was carried unanimously.

The CHAIRMAN: That is the whole of the business for which you were called together, and I thank you for your attendance.

VOTES OF THANKS.

Mr. GEORGE HOWLETT said the meeting could not break up without passing a very hearty vote of thanks to the Chairman and Directors for their direction of the Company's affairs during the half year, which had no doubt been a very trying and difficult one for them. He was not at all pessimistic about the future; they had been in difficulties before, and had got out of them. All gas concerns in the country were in much the same position as themselves in London; and all through the high price of coal. The increase could not go on *ad infinitum*; it must stop. Force of circumstances had brought it about, as it had done in the past. The Board deserved a vote of thanks for having brought them safely through, and paid them a dividend. He hoped that by this time next year good progress would have been made towards better times. He felt sure the Board would keep as long as they possibly could from raising the price of gas; but, if the time ever came when it must be raised, he felt sure that the public would know it was an absolute necessity, and that no blame could fall on the Directors. He thought the Board deserved their special thanks for having this half year done so well in bringing out such a good result.

Mr. S. FRY seconded, and said that the hearts of all shareholders warmed towards the Directors on the present report. The Board must have had six months' anxiety caused by circumstances which it was impossible for them to control, and he thought shareholders should feel particularly grateful to them.

The motion having been carried unanimously,

The CHAIRMAN said: For my colleagues and myself, I beg to express our indebtedness for your very kind appreciation of our difficulties, and for the manner in which you have expressed yourselves with regard to them. The past year has been one of very great anxiety indeed to the Board. It is very pleasing to us to know when we come here that you understand these difficulties as well as you must do to have expressed yourselves in the admirable terms of the mover and the seconder of the motion of thanks. As the mover of the motion said, the very last resort of the Board would be the raising of the price of gas. If we are driven to the adoption of such a course, we feel that the public of South London have sufficient faith and confidence in our conduct in the past to know that we had only done it because we were absolutely obliged. We are not pessimistic in the matter. We believe it is impossible for the price of coal to continue at its present high figure; and that we shall—there is no reason why we should not—within a comparatively short time buy raw material at a fair and reasonable price. I thank you very heartily indeed on behalf of myself and my colleagues for your vote of thanks, which has been specially grateful to us, having regard to the terms in which it was proposed and seconded.

THE OFFICERS AND STAFF.

Before I sit down, I must take the opportunity of proposing a vote of thanks to our officers and staff, because our difficulties in times like these are shared by them. I must say that they have, as a body, admirably lived up to our requirements; and I know they will go on all right. When money is plentiful and coal is cheap, things are comparatively easy; but in times like these, when the expenditure of every penny has to be carefully scrutinized, and we are face to face with improvements and alterations which are desirable and almost essential, yet they have to restrain their ardour, if I may say so, and to postpone those improvements until times are more favourable. I will therefore ask you to pass a vote of thanks to the officers and staff, and I couple with this request the name of our Chief Engineer, Mr. Gibb, whom I will ask to respond, after the motion has been duly seconded, for the technical staff. It has become something more than an engineering staff, because we have not only to consider engineering questions, but we have to discuss and consider physical and chemical problems—first of all the preparation of materials, then purification, and then the supply of gas. All these things are now done on finer and more scientific lines than in years gone by. We are making progress in the scientific application of gas to the various requirements of the public. We cannot be content with groping in the dark; and we have organized a set of trained men who are experts in considering these problems—first of all in the laboratory, whether chemistry or physics, and then in working out their application on a large scale. From the technical standpoint, a vote of thanks was never better earned than it is to-day; and what is true of the technical branch, is also true of the commercial branch. There is one thing we have, and that is the stimulus of competition, and also the demands which the public make upon us for a good service. So that our commercial staff, like our technical staff, is tuned-up to a higher degree of perfection than was the case in the past. I have much pleasure in moving a hearty vote of thanks to the engineering and commercial staffs of the Company.

The motion was seconded and was carried unanimously.

REPLIES ON BEHALF OF THE STAFFS.

Mr. W. DOIG GIBB (the Chief Engineer), in the name of the technical staff, thanked the meeting for having passed so kind a vote of thanks. The Chairman took great interest in the various interesting and novel pieces of engineering and chemical research which were now being carried out; and he (Mr. Gibb) believed the technical staff were doing their best to bring them to successful maturity.

Mr. F. M'LEOD (the Secretary) said the remarks which the Chairman had been good enough to make about both the commercial and the clerical staff would be very much appreciated by everyone concerned, and all would do their best to maintain and extend during the coming year the increased business secured during 1912. He thanked the meeting for the kind vote.

The proceedings then terminated.

SOUTH SUBURBAN GAS COMPANY.

The First Meeting of the Amalgamated Companies.

The Ordinary Half-Yearly Meeting of the Company was held last Friday at De Keyser's Royal Hotel, Victoria Embankment—Mr. CHARLES HUNT presiding.

The SECRETARY (Mr. Wilfrid Wastell) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

WELCOME TO THE SHAREHOLDERS OF THE AMALGAMATED COMPANIES.

The CHAIRMAN, in moving the adoption of the report and accounts, said: This meeting is of special interest, because it is the first one of the united Company; and it is my very pleasurable duty to offer a cordial welcome to those stockholders and shareholders of the late Bromley and Crays and West Kent Companies who may be here for the first time to take part in our proceedings. I am sure we are all of one mind in hoping that this union of the three undertakings, which has now been carried into effect, may prove to be a fortunate one, and in the best interests of all concerned. Mr. Alexander Dickson, the late Chairman of the Bromley and Crays Company, joined the Board last autumn under the provisions of the Act, and is with us to-day in his capacity as Director.

THE COAL POSITION.

When I had the honour of addressing you last autumn, we were in the happy position of being able to congratulate ourselves on having escaped any ill-effects from the national coal strike, which had pressed so hardly upon other industries of the country during the period then under review. Our stocks of coal and oil, purchased at normal prices, had proved ample for our requirements during, not only the strike period, but also for the additional period during which contract deliveries continued to be interrupted. The Company had consequently been spared the unpleasant necessity of purchasing coal at the almost famine prices that ruled both before the strike and immediately after its termination; and it did not seem unreasonable to expect that after stocks (which had been depleted by the strike) had been replenished, the price of coal would moderate. Our hopes, however, were rudely dispelled at contract time; for then the prices that had to be paid were the highest experienced by this Company for

some years, and I believe the highest paid recently by any London or Suburban Company. This was particularly hard, having regard to the reductions of prices of gas to which we were committed under the scheme of amalgamation—these having been largely based on a continuance of the existing prices for coal; and it naturally made our position a very anxious one. It is, of course, beyond our power to resist abnormally high prices so long as the demand for coal is sufficient to sustain them; and this, so far, has been the case, owing to the great and unprecedented activity of nearly all branches of industry. But it may not be amiss to suggest that extreme prices one way or the other can hardly be to the permanent advantage either of the coal owners or their most regular customers, who are the gas undertakings. It must be at least as unpleasant to a coal owner to have his pits standing more or less idle in times of bad trade as it is embarrassing to a gas undertaking to be obliged to raise the price of gas; and it ought to be possible to avoid both—the one and the other—by a mutual arrangement in which the miners themselves might participate. It is desirable to remember, moreover, that, so far as the cost of a necessity such as coal exceeds what is a fair and liberal return both for capital and labour, including all attendant risks, it constitutes a tax upon the industries of the country for the benefit of a few, which is contrary to national polity.

TRADING RETURNS.

Comparing the accounts as closely as it is at all possible to do with those of the three Companies for the corresponding period of 1911, the revenue account shows the cost of coal (in which are included those of oil and coke used for gas-making purposes) to have been more by about £13,000, which, to the extent of more than one-half, was made up by increased receipts for residuals. Tar was, and continues to be, what in commercial parlance is called "an excellent market;" and higher prices were also obtained for coke, although by no means corresponding to the advance in the price of coal. Sulphate of ammonia remained almost stationary; and the present tendency as regards this product is towards slightly lower prices. On the other side of the account, the loss of revenue consequent upon the various reductions in the prices of gas, has been made up to the extent of rather more than four-fifths by increased consumption, which, of itself, is an encouraging result of what may be called our first half-year's trading. The other items in the account are not easy to compare with those of the corresponding half year, nor do they call for any special remark. Passing, therefore, to the last but one on the left-hand side of the account, it is seen that there is a credit balance, representing the trading profit for the half year, of £38,804, which happens to be only about £300 short of the total balances of the three Companies for the corresponding period of 1911, when prices of coal were considerably lower. Bearing in mind this fact, and also that some expenses incidental to the amalgamation have had to be borne which will not recur, I hope you will agree that this result is satisfactory, and a hopeful augury for the future of the undertaking as now constituted.

STARTING WITH A CLEAN SHEET.

Turning now to the net revenue account, it will be seen that against this there have been charged certain special expenses incurred under the amalgamation scheme—viz., compensation to Directors and Auditors of the two Companies, and duties payable to the Inland Revenue Department, which takes its toll out of the gas consumer in more ways than one. These expenses have consequently been wholly met out of accumulated balances, instead of creating a suspense account, so that in this respect also we start the New Year with a clean sheet. After meeting these payments, and providing for debenture and mortgage interest, there remains available for distribution a sum of £46,408, out of which full statutory dividends are recommended to be paid as set forth in the report, carrying forward to the next half year the sum of £12,837. Proprietors are aware that, under the amalgamation scheme, our dividend obligations are increased by an additional 10s. per cent., secured to the proprietors of the late Bromley and Crays Company by the distribution to them of an equivalent amount of South Suburban ordinary stock, and that additional dividend is also payable to the shareholders of the late West Kent Company as represented by the increase of capital called up by that Company. It will therefore I trust be as gratifying to them as it is to the Directors to find that, in addition to meeting these increased dividend liabilities, the profit made during the half year is sufficient to pay the all-round increase of 3s. 4d. per cent., to which all proprietors alike are entitled by the present price of 2s. 3d. per 1000 cubic feet in the old South Suburban area. At the same time, we feel that, even had it been necessary to draw upon reserves in order to pay this extra dividend, it would have been justifiable to do so—seeing that the essence of the sliding-scale arrangement is that not the consumers only, but the shareholders and employees also, should benefit by every reduction made in the price of gas. The employees get for their share an additional ½ per cent. bonus on their year's earnings, making their present rate of bonus 7½ per cent., in which bonus those employees of the two Companies taken over who have become co-partners will, as a matter of course, participate. The possibility of continuing the present price of gas, and consequently of maintaining the increased rate of dividend and bonus, must depend very largely on what may have to be paid for next year's supply of coal. Our endeavour will be to avoid raising the price of gas; but if this should prove to be necessary, it may be assumed for certain that we have succumbed to the inevitable. Advantage has been taken of our new departure to write-down the investments of the reserve and special purposes funds to something like their present market value. The special purposes fund takes the place of our old insurance fund, the purposes of which it combines with that of a kind of renewal fund in accordance with the latest parliamentary idea. And instead of being limited, as was the insurance fund, to one-twenty-fifth of the paid-up capital, including premiums, it may be brought up to one-tenth of the paid-up capital, *excluding* premiums. In this connection may be mentioned another very desirable change made by Parliament—viz., in the amount of undivided profit that may be carried forward from one half year to another. This, under our old Act, was limited to £20,000; but, under the new Act, it may amount to a full year's dividend. Great importance attaches to this provision, because a large carry-over, when circumstances permit of its accumulation, gives security against a rise in the price of gas consequent on a temporary rise in the price of coal.

LINKING-UP THE DISTRICTS.

The capital expenditure for the half year has been upon a scale to which during recent years we have been wholly unaccustomed; much the greater portion representing the cost of the connecting mains that were required to complete the linking-up of the various manufacturing works and distributing stations. We have had to link up by mains extending from the Lower Sydenham to the Bromley works, and from Crays to Crayford. It is probably known to many of the proprietors that the West Kent Company had originally two works—one at Erith and the other at Crayford—just as the much larger Bromley and Crays Company, which was formed by the union of two Companies, had works situated both at Bromley and at Crays. In each case, one manufacturing works was eventually discontinued, only the gasholders being retained for distribution purposes; so that there are to-day four distributing stations situated in the four most populous centres of the new areas. These and the other less populous centres may some day or other join hands, just as Bromley and Beckenham now do, although quite within living memory Beckenham was a village much the same as West Wickham is to-day. In course of time, therefore, it is not at all unlikely that these distributing stations, or some of them, may have to give place to a system of direct distribution; but so long as they continue to be necessary, it is essential for them to be all linked together and to the cheapest manufacturing station, which, for the time being, is the Lower Sydenham works, whence gas is now being sent through Bromley as far as Erith—a distance of about 17½ miles.

THE CHEMICAL CLAUSE.

At our last meeting, I referred to a clause that Parliament had imposed upon us, as well as upon other gas undertakings in the same position as ourselves, of requiring its assistance in the endeavour to improve the conditions of gas supply, prohibiting us from doing what down to that time it had never entered into our heads to do—viz., purchasing from other gas undertakings gas residuals to work-up with our own. This clause—known as the chemical clause—was promoted by a very powerful and influential body called the Alkali Manufacturers' Association, formed for purely trade purposes, and working not in the public but absolutely in their own interest. We offered to the clause the strongest opposition in our power, not only as regards our own Bill, but also in regard to the Provisional Order promoted by the late West Kent Company, in which as prospective purchasers of that undertaking we had become interested. The Order passed the Unopposed Committee of the House of Commons without the objectionable clause being inserted; but in the House of Lords it was less fortunate. There the clause was inserted at the instance of the Alkali Makers' Association, in the teeth of a considerable body of evidence that had been prepared to support its exclusion, and much of which the Committee refused to hear. Our resistance, however, proved to be the proverbial "last straw," which convinced the Parliamentary Authorities of the necessity for further action; and a Joint Committee of both Houses was appointed to fully consider the question. I am very pleased to be able to say that this Committee, after a full and patient hearing of all that could be urged on both sides of the question (in the course of which our esteemed colleague, Mr. Carpenter, did yeoman service for the gas industry), in effect reversed the previous decision, by reporting that they saw no reason why gas undertakings should be under restraint in this particular—in other words, that they should be left free to help one another in this very important branch of their business. This is all that the gas industry has been contending for; and our best thanks are due to those who, in any way, contributed to bring about so satisfactory a conclusion.

NATIONAL INSURANCE.

We are glad to be in a position to say that practically all the difficulties which appeared to surround the application of the National Health Insurance Act have been overcome; and the Company's old Sick Society has been succeeded by an Approved Society, securing to the employees all the benefits of the former, together with the additional benefits provided by the Act. This Society includes practically all the eligible employees at all the works; and the management of it has been entrusted by the members to the Co-Partnership Committee, who rendered much valuable assistance in preparing the rules and in other matters incidental to its formation. The sanction by the Health Commissioners to this scheme of management as an alternative to the separately elected Committee having a majority of subscribing members provided for by the Act, is due to the initiation of Mr. Carpenter and the South Metropolitan Company, and is a striking testimony to the value of co-partnership and the confidence with which it is regarded. That this system continues to give satisfaction goes without saying; and we may further rejoice, as one of the pioneers of the movement (for it has been in operation with this Company since 1893), at the way in which it has at length taken hold of the public mind as the one permanent remedy for labour unrest.

CONFIDENCE AS TO SUCCESS.

It only remains for me to say that the work of consolidating the undertaking is proceeding smoothly and satisfactorily; the officials and employees of all grades performing their several parts in a manner worthy of all praise. Their hearty co-operation, hitherto so signally displayed, inspires every confidence in the continued success of the undertaking.

Coal and Freedom in Residuals Dealings.

Sir J. Fortescue Flannery, Bart., M.P., in seconding the motion, said the outstanding feature of the report and of the accounts was the joining of two other Companies to their own, and the promise of success that the Board believed was given in the first half-year's working, which would show they were justified in bringing about the amalgamation. Whether or not it was successful, the credit of overcoming the great difficulties that existed rested, as they all recognized, with the Chairman; and he (Sir Fortescue) believed that, in the not distant future, Mr. Hunt would be congratulated upon the result of his very

successful and arduous labours in this regard. Another outstanding feature was the enormous and unjustified increase, as they regarded it, in the price of coal; and but for the advance in the values of bye-products, he did not know what would have happened to the gas industry as a whole. Fortunately the bye-products had come to their rescue; but the doubtful question for the future was as to how far they might have an equation between the price of coal and the price of the bye-products which would compensate the one for the other. It was true they had not only a higher price of coal, but they had a lower cost of gas, and a higher dividend. The result was, as he had said, entirely dependent upon the assistance received from the bye-products. Regarding the interference of the chemical manufacturers with the proceedings of Parliament, his opinion was like that of his two colleagues, the Chairman and Mr. Carpenter. It was his duty to follow as closely as he could in the House this interference by the chemical manufacturers; and he thought they were entirely unjustified. As gas makers, they were surely entitled to deal with the bye-products of their industry in the best possible manner. They were already hampered enough by legislation, which restricted their operations as public parliamentary companies; and at least they might have the liberty of dealing with their own bye-products without restriction. The attempt made by the chemical manufacturers was absolutely unjustified by anything that existed in the way of precedent, or by logical reasoning on the question of freedom of trade. However, fortunately owing very largely to the special efforts the Chairman of the South Metropolitan Company and other of his colleagues made, the injustice was warded off; and Parliament had now decided, in a way which he thought would form a precedent for the future, that reasonable freedom should be reserved to gas undertakings for dealing with their bye-products as between one gas undertaking and another.

The CHAIRMAN, in reply to an inquiry as to why the item for Directors' fees had risen from £940 in the first half of the year to £2284 in the second half of the year, said it was in consequence of the fact that, at the last meeting, the proprietors requested the Directors to divide the fees that had not hitherto been appropriated, but to which they were entitled. They could not continue to do this, as there were no more arrears.

Mr. R. GARRAWAY RICE remarked that the shareholders of the old West Kent Gas Company had listened with great interest to the address of the Chairman. This meeting was of peculiar interest to those of the proprietors who were shareholders in the West Kent Company from its beginning. He (as Deputy-Chairman of the West Kent Company) had from the first been in favour of the amalgamation. He believed it was a good thing for the South Suburban Company, as they now had additional area, as well as the capital with which to work it properly. He believed the amalgamation would be remunerative to that Company, as it would be satisfactory to the Companies that had been brought into it.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. G. ROSS, a dividend was declared at the rate of 5 per cent. on the preference stock, 6 per cent. on the ordinary stock, and 5½ per cent. on the West Kent ordinary stock, less income-tax.

Mr. JOHN BORASTON moved the re-election of Mr. Charles Hunt as a Director. He remarked that the report that had been adopted was a monument to the care Mr. Hunt had devoted to the interests of the Company, and to the courage, foresight, and business ability with which he had carried through the prolonged negotiations with the two Companies with which they had amalgamated. Mr. Hunt stood in the front rank of gas engineers, he was a keen business man, a large-minded and generous employer, and a staunch friend.

CORDIAL NEGOTIATIONS.

Mr. ALEXANDER DICKSON, in seconding the motion, thanked the Chairman for the cordial welcome he had given to the proprietors of the old Bromley and Crays Company, and to his old colleagues and himself. He regarded it as one of the most pleasant events in his public life that his acquaintance with Mr. Hunt came about in the autumn of two years ago through a memorable letter that he addressed to him (Mr. Dickson) as Chairman of the Bromley and Crays Company. The importance of this communication was evidenced by the amalgamations that had since been effected. Both of them met with powers from their colleagues; and they were not long in being fully assured as to the prospects which were before an amalgamated Company. The negotiations were discussed and carried through in the spirit of fairness which, he thought he might say, ultimately dominated and crowned the event which had met with such general satisfaction at the hands of the interests involved. He should ever retain a sense of pride that he was associated with Mr. Hunt, and accomplished with him, by the aid of their colleagues of the three Boards, the welding of the three Companies into one large undertaking, which possessed such potentialities for future development.

The motion was heartily agreed to.

MR. CARPENTER'S UNIVERSITY DISTINCTION.

The CHAIRMAN, in acknowledging the continued confidence of the proprietors, observed, with reference to Mr. Dickson's remarks—too flattering remarks he thought them—that had he not, as representing the South Suburban Board, been met by Mr. Dickson, as representing the Bromley and Crays Board, in the same spirit that he had described, the negotiations could not have succeeded. Proceeding, he proposed the re-election of Mr. Charles Carpenter, and took the opportunity of congratulating him upon the distinction that had been recently conferred upon him by the University of Leeds. That University had set an example to other Universities in recognizing gas engineering as a science. He was sure the proprietors would agree that upon no one could the degree of Doctor of Science have been more fitly conferred than upon Mr. Carpenter.

Mr. W. G. WALLER seconded the motion, which was also cordially passed.

Mr. CARPENTER briefly acknowledged his re-election.

THE RETIRING AND THE NEW AUDITOR.

The CHAIRMAN remarked that Mr. Thomas Guyatt, who had been one of their Auditors for the past thirteen years, had intimated his intention of not offering himself for re-election on account of advancing age. They were all sorry, because, as was well known, Mr. Guyatt was an exceedingly capable man, and was very acceptable to the Board. They hoped that he would be spared for many years to attend their meetings, and give them his countenance and advice.

Mr. GUYATT then proposed that Mr. Ernest W. Drew be elected to the vacancy in the auditorship, with a joint fee to the Auditors of £140 a year. He spoke of the well-recognized position held by Mr. Drew as a chartered accountant, and said he was sure he would be the right man for the appointment.

Mr. FISHER seconded the motion, which was unanimously carried.

Mr. DREW sincerely thanked the proprietors, and assured them of his best attention to the interests of the Company.

INCREASE OF DIRECTORS' FEES.

Mr. HAROLD GUNDRY said he was sure he should have no difficulty in persuading the proprietors to agree to the resolution he had to propose. They were a successful Company; their property was in the highest state of efficiency; they had given satisfaction, he believed, to their customers; and he was sure the dividends had given the proprietors satisfaction. The Company, in common with the rest of the gas industry, had had to pass through a bad coal strike, and had had to face a higher price for coal. They had come through these difficulties successfully; but benefits of this kind did not arise by chance. They were dependent to a great extent on the skill, vigilance, and unremitting labour of the Directors. He did not think any proprietor would suggest that the Directors had been overpaid in the past. But what was sufficient remuneration in the past, was not sufficient remuneration at the present time. They had merged in the Company two other Companies; and this had thrown on the Board an enormous amount of work. It was only fair that the Directors' fees should be increased accordingly. The area served by the original South Suburban Company was 15 square miles; while the two Companies that had been merged in it had between them an area of no less than 75 square miles. Before the amalgamation, the Bromley Company had nine Directors, who drew fees amounting to £1430. The West Kent Company had six Directors; and they drew £500 in fees. All these Directors disappeared excepting one, who had become a member of their Board for two years. It would be seen that they had in Directors' fees alone made a large saving. Their own Directors were authorized to divide between them £2500 a year; but, as a matter of fact, they had only been drawing £2100. Considering the money that had been saved, and the immense amount of work thrown upon the Directors, he ventured to suggest that the proprietors should allow them to draw another £1000. He therefore moved that the Directors should now be entitled to £3500 per annum, free of income-tax.

Mr. HUGH WYATT seconded the proposal, and remarked that he did not think the increase of £1000 would more than meet the case.

Alderman T. R. PORTER remarked that he always understood that amalgamations of companies were effected for the purpose of securing a saving. He agreed that the labourer was worthy of his hire; but it was a question whether the time was opportune for raising the Directors' fees by £1000. They had only just launched on this large combination; and they were now faced with a high price for coal. He therefore moved, as an amendment, that the proposal be adjourned until the next half-yearly meeting.

Mr. R. GARRAWAY RICE was of opinion that the proposer of the motion had made out a good case.

Dr. BARKWELL seconded the amendment. He also thought the time was inopportune for an increase such as was proposed. The future would show whether the Board should have a further increase; and he considered the matter should be deferred at least twelve months.

Mr. W. R. HERRING supported the motion. He was struck by the expression that "the time was inopportune." When they were putting an extra load on anyone, then, if they wanted increased energy and attention, was the very time when they ought to increase remuneration. Instead of the amendment they had before them, he should have been quite prepared to suggest one making the amount of the fees £4000.

Mr. F. W. CHURCH also supported the motion, remarking that, if they wished technical experts on their Board, they ought to pay for their services.

The amendment was negatived by a large majority; and the resolution was then carried, with only two or three dissentients.

VOTES OF THANKS.

The CHAIRMAN proposed a vote of thanks to the officers, staff, and employees of all grades. The proprietors all knew of the capacity and devotion to the service of the Company of Mr. Shoubridge. Mr. Wastell, their new Secretary, was present at their meeting for the first time; and he had already proved himself a most valuable officer. Mr. Heading, Mr. Floate, Mr. Whimster, Mr. Baldry, and the late Acting Secretary of the Bromley Company (Mr. Wicks) had all rendered them efficient service. Mr. Wicks would shortly retire on a well-earned superannuation. Mr. Woodward, who was the retiring Engineer of the Bromley Company, was with them during the past half year, and had carried on the works most efficiently.

Alderman PORTER seconded the motion, which was cordially carried.

Proposed by Colonel B. H. LATTER, and seconded by Mr. THOMAS GUYATT, the services of the Chairman and Directors were also heartily acknowledged.

Proposed Gas-Works Extensions at Ossett.

The Ossett Corporation Gas Committee have appointed a Sub-Committee to inquire into, and draw up a report upon, the extension and re-modelling of the gas-works. The Chairman, in speaking on the matter at the Council meeting, stated that the consumption of gas is increasing largely, and that the quantity made has doubled in the past ten years, and that they would have to spend at least £20,000 at an early date. The Sub-Committee, along with Mr. A. E. Mottram (the Gas Engineer and Manager), are now visiting a few works, inspecting the different kinds of vertical and machine-charged retorts, with a view to seeing which are likely to be most suitable for Ossett.

SHEFFIELD UNITED GASLIGHT COMPANY.

Report and Accounts.

In the report of the Directors of the Sheffield United Gaslight Company for the twelve months ended Dec. 31, to be presented at the ordinary general meeting on the 10th prox., they say that the demand for gas, not only for lighting and domestic use, but also for industrial purposes such as furnaces and gas-engines, continues to show satisfactory expansion; the quantity sold during the past twelve months having exceeded that of 1911 by 243,968,000 cubic feet, or 6·13 per cent. The usual interim dividend of 5 per cent. was paid for the half year ended June 30 last; and after providing for the dividend for the remaining six months of 1912, and writing-off depreciation on the reserve fund investments, there will remain a balance of £10,100 to be added to the amount carried forward from previous accounts. As is generally known, the price of coal has been considerably increased. This is largely due to the scarcity caused by the strike last spring, when stocks both in this country and on the Continent were depleted; and it is to be hoped that in the course of a few months a more normal state of affairs will prevail. So far as the accounts now presented are concerned, they are only affected to a limited extent, as deliveries under the more favourable contracts made in 1911 were not completed until the end of August. With a view to further encourage the use of gas for manufacturing purposes, and also to assist the movement for the abatement of smoke, the Directors have decided to make a reduction, commencing in April next, of 1d. per 1000 cubic feet in the price of gas where the consumption exceeds 500,000 cubic feet per annum, and also for gas-engines and the public lamps. The Company's charges will then be 1s. 3d., 1s., and 10d. per 1000 cubic feet, according to consumption. The average price at which gas has been supplied during the past twelve months is 1s. 1·83d. per 1000 cubic feet.

An extraordinary meeting, to be held immediately at the close of the general meeting, has been called to sanction the issue of the balance of the debenture stock authorized by the Gas Orders Confirmation (No. 2) Act, 1893, as and when required by the Company.

The accounts accompanying the report show that the revenue from the sale of gas for public and private lighting during the year 1912 was £241,225; meter and stove rentals came to £20,757; residuals produced £191,788; and the total receipts were £456 415. The principal items of expenditure were: Manufacture of gas, £285,889, distribution, £31,067: rents, rates, and taxes, £19,732; and management, £13,069—the total expenses being £353,051. This left £103,364 to go to the profit and loss account, the balance on which stands at £146,815.

CROYDON GAS COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented at the half-yearly meeting of the Croydon Gas Company on Friday the Directors state that the sales of gas in the six months ended Dec. 31 exceeded those of the corresponding period of 1911 by 9·54 per cent.; and the number of consumers increased by 1096. The number of stoves on hire augmented by 613 cookers and 1716 fires, while 71 and 318 respectively were sold to consumers; representing a total increase of 2718 in gas-stoves. In addition, a large number of appliances for water heating for domestic purposes were sold or let on hire.

The accounts accompanying the report show that the total revenue was £137,595, of which £92,315 was derived from sales of gas, £11,114 from rental of meters, stoves, and house fittings, and £33,982 from sales of residuals. A sum of £64,781 was expended on manufacture, and £22,380 on distribution; rent, rates, and taxes came to £4947; management cost £4783; and the total expenses (inclusive of £1400 for the co-partnership scheme) were £103,389. The balance carried to the profit and loss account is £34,206; and the amount available for distribution is £48,030. The Board recommend the payment of dividends at the rates of 15, 12, 10, and 5 per cent. per annum, all less income-tax, on the various classes of stock. This will absorb £23,599, and leave a balance of £24,431.

The statements relating to the working show that 48,545 tons of coal and 454,356 gallons of oil were used during the half year to manufacture 803,187,000 cubic feet of gas, of which 749,814,400 feet were sold and 759,348,500 feet were accounted for. The estimated quantities of residuals produced were: Coke, 29,127 tons; breeze, 6069 tons; tar, 488,628 gallons; ammoniacal liquor, 1,450,260 gallons—the make of sulphate being 497 tons.

PORTSEA ISLAND GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday—Mr. R. Edgcombe Hellyer in the chair.

The profit and loss account showed an available balance of £41,341, and the Directors recommend the declaration of a dividend for the half year ended Dec. 31 at the following rates per annum: 13 per cent. on the "A" and "B" shares, 12 per cent. on the "C" shares, 10 per cent. on the "D" and "E" shares, and 5 per cent. on the 5 per cent. (maximum) stock; leaving a balance of £23,409 to be carried forward. The demand for gas in the half year was substantially in excess of the corresponding period of 1911; and the number of consumers and the various cooking and heating appliances in use steadily increased. A rebate of 5 per cent., equal to 2d. per 1000 cubic feet, has been granted to consumers using prepayment meters in respect of amounts due for gas used after the 1st ult.

The Chairman, in moving the adoption of the report, stated that, compared with the half year ended Dec. 31, 1911, the number of consumers had increased by 1323 to a total of 46,997, and the gas-cookers and other heating appliances in use by 1098, to 28,888; the quantity of gas sold being 673 million cubic feet, compared with 643 millions. Having regard to the industrial conditions, he considered that the financial results of the working were more than satisfactory, as not only had the full statutory dividend been earned, but the Directors had been able to make some provision towards the reconstruction of works and plant now in progress. The total revenue showed an increase of £9472; being partly attributable to the sale of gas and the improved prices obtained for residuals. Out of this increase, a large additional expenditure had to be met—viz., £9319, principally for coal and oil—resulting in a net increased profit of £43 for the half year. Proceeding to comment upon the Directors' report, he referred to the additions which are being made to the manufacturing plant. He stated that the whole of the contracts had been let for reconstructing the interior of No. 2 retort-house at Flathouse, and that the work, which is now in progress, would involve an expenditure of approximately £20,000, of which £2776 had been paid, and a further £6500 had been transferred to the extraordinary renewals fund. Comparing the price of coal with the charges in previous years, he quoted figures showing that since 1910-11 there has been an increase of no less than 3s. 9½d. per ton, and a proportionate advance in the cost of oil. He remarked that the half year had been one of very considerable anxiety to the Directors, and great credit was due to the Engineer and General Manager (Mr. J. D. Ashworth) for the manner in which he had dealt with the difficulties which had arisen.

The report was adopted.

The usual dividend having been declared, the retiring Directors and Auditor were re-elected, and the meeting terminated with the customary complimentary vote of thanks to the Chairman and Directors, the Engineer and General Manager, the Secretary (Mr. H. A. Stibbs) and staff generally, for their efficient management of the Company's business.

CHESTER GAS COMPANY.

The report for the half year to Dec. 31, which was presented at the meeting of the Chester United Gas Company on Monday of last week, stated that, though the new coal contracts were made at a considerably advanced price, the Directors felt, with the market for residuals in a sound condition, they could still further reduce the price of gas. They therefore lowered the charge, as from July 1 last, from 2s. 8d. to 2s. 6d. per 1000 cubic feet, subject to the same scale of discounts as before. This reduction had been much appreciated by the consumers, and, in conjunction with the concession to prepayment meter users (who are now supplied with 30 cubic feet of gas per 1d., instead of 25 feet as before), had undoubtedly had considerable influence in assisting the very satisfactory development shown in the largely increased consumption of gas during the half year. The balance to the credit of profit and loss account, after providing for payment of interest on the debenture stock and the dividend on the preference stock, was £7573. The Directors recommended the payment of a dividend on the ordinary stock, in respect of the six months to Dec. 31, at the rate of 2½ per cent.—making with the interim dividend the maximum rate of 5 per cent. for the year.

The new Chairman of the Company (Mr. J. M. Frost) said he was fortunate in being able to put before the shareholders, on the first occasion of presiding, one of the best balance-sheets ever submitted by the Board. The gas sold accounted for an increase of £466; and as the reduction in price would have involved a reduction in revenue of £700, the value of the increased quantity of gas sold had been £1166. Residuals were responsible for the remainder of the increased revenue of £2000. On the other hand, coal had cost £1610 more.

The report was adopted, and a vote of thanks was passed to the Chairman, Directors, Secretary (Mr. F. A. Pye), Engineer (Mr. John C. Belton), and other officials.

DERBY GAS COMPANY'S PROFITS.

The Derby Gas Company have always held a high place among Provincial undertakings for sound management and substantial financial results. The report presented at the 93rd ordinary general meeting last Friday was again of an encouraging character; a dividend of 5¾ per cent. for the year being declared. Col. George Gascoyne, J.P., was able to make the satisfactory announcement that there had been an increase of nearly 5 per cent. in the amount of gas sold; the consumption having exceeded 1000 million cubic feet, yielding an income of about £102,000. After providing for the amount necessary for labour and conversion, residual products had brought in £49,703. The Directors have decided upon reducing the price by 2d. per 1000 cubic feet, which will result in all round lowering of the rate, save for gas sold in bulk under special contracts. The result of the reduction will be equivalent to a grant of £6700 per annum out of revenue. The information was forthcoming, in the course of the meeting, that outside the borough the Company now supply twenty parishes with a population of 33,000. Over 2800 new gas cooking-stoves were let out during the year; the total number now in use being 18,860. The Chairman, Directors, Engineer (Mr. J. Ferguson Bell), Secretary (Mr. H. Bullivant), staff, and employees were cordially thanked for their services.

Bills Royal Assented.—In the House of Lords last Friday, the Kirkcaldy District Water Order Confirmation Bill and the Sheffield Corporation Bill—two measures of which the progress has been somewhat impeded—duly received the Royal Assent.

Gas Profits at Walsall.—The annual balance-sheet of the gas undertaking has been issued by the Walsall Gas Committee, and shows a net profit of £9489—an increase of £727 on the previous year. Of this, £6000 has been transferred to the borough fund in aid of the rates, and £3489 has been carried to the current year's account. The Committee mention that they have decided to reduce further the price for gas supplied to customers using prepayment meters by increasing the discount allowed from 10 to 15 per cent. It is stated that the sales in respect of prepayment meters last year showed an increase of £1300, the total being £11,664.

ILKESTON GAS-WORKS EXTENSIONS.

Application for a Loan—"Hoodwinking" the Local Government Board.

[From Our Local Correspondent.]

Although more than a year has elapsed since the alarming gasholder explosion occurred at Ilkeston, there was, figuratively speaking, an echo of the disaster last week, when an inquiry extending over two days was held on behalf of the Local Government Board relative to an application by the Corporation for authority to borrow £50,000, of which no less than £29,116 is required for purposes connected with the gas undertaking. The admission was forthcoming that money originally raised on loan was not spent upon the particular type of work for which sanction was sought; and incidentally the evidence afforded a significant illustration of the costliness attendant upon modern schemes of municipalization. The youngest of Derbyshire boroughs seems to have fared much better financially under the old Local Board *régime* than since it became possessed of the powers of a Corporation; for whereas prior to the latter event, which happened only about 25 years ago, the rates for all purposes did not exceed the modest proportions of 3s. 1½d. in the pound, they amount for the current year to no less than 10s.; the only existing reserve fund being the trifle of £859 in respect of the gas undertaking. Following the example of their larger neighbour, Nottingham, the new burgesses were not content until an electric tramway system had been laid down, the revenue of which, as was to be expected from the comparatively limited population to be served, has proved entirely disproportionate to the expenditure involved. The loss indeed upon this "white elephant" has amounted, according to the admission of the Town Clerk at the inquiry under notice, to no less than the equivalent of a 9d. rate. The outlook is fortunately of a more hopeful character in relation to the gas undertaking, though the effect of the check experienced through last year's disaster is still being severely felt. Some sanguine expectations are entertained also as to the possible earning powers of the Electricity Department, seeing that simultaneously with the application in relation to the new gas engineering projects £16,000 was also asked for on account of the Corporation's younger branch of municipal trading.

To Mr. R. C. Maxwell, barrister, and Mr. T. C. Ekin, M.Inst.C.E., the Inspectors conducting the inquiry on behalf of the Local Government Board, the Town Clerk (Mr. S. F. James) afforded the information, at the opening of the proceedings last Wednesday, that the gas-works were acquired by the Local Board in 1879; the purchase price being £25,000. By March 31 last, the net indebtedness had risen to £65,036. The figures, however, showed a substantial margin of profit; for whereas during the year up to the date just named, the gross expenditure was £17,121, the income amounted to £20,659. Steady increase in the output had rendered it inevitable that more accommodation should be afforded at the gas-works; there having, in 1911, been an addition of nearly 3 million cubic feet to the consumption, compared with the year 1910. The opinion was held that but for the unfortunate disaster last year, the consumption would have increased—not, perhaps, in the same degree as in 1911, but still to a very marked extent. As it was, there was an increase of 1¾ million cubic feet. It was proposed to purchase land and premises contiguous to the existing works. The property included houses which were seriously damaged by the explosion and the rush of water that followed, when a servant girl who sought refuge in a cellar beneath a shop was drowned. A claim for compensation had been made upon the Corporation by the owner of the damaged premises; and the purchase of the property had been decided upon by the Council. Probably all the land which had been scheduled would be required for the purpose of the gas-works extension. The Corporation were originally asked £1100 for the houses; but their valuer fixed the amount at £750, and £800 was ultimately agreed upon as the sum to be paid, free of all cost.

It was when Mr. F. C. Humphrys, the Gas Engineer to the Corporation, was giving evidence regarding the dismantled gasholder and the scope of the new works that some very pertinent observations were made by one of the Inspectors regarding what he described as a process of "hoodwinking" the Local Government Board. It seems that a public inquiry was held on May 13, 1908, with regard to the money to be borrowed on account of the new holder; a loan of £8000 being then applied for. The specifications presented included the provision of a brick and puddle tank; but before the inquiry took place the Gas Committee changed the plans, and determined upon the erection of a spiral-guided holder, with a steel tank, at a cost of £5000. This circumstance, it was now admitted, was not explained to the Inspector who conducted the inquiry; the plans laid before him being for a brick and puddle tank. By the change to the steel tank, the stability of which formed one of the main considerations at the subsequent inquiry, a saving of £3395 was effected. The application for authority to borrow the larger sum was, however, persevered in; the fact of the change of plans not being publicly related at the time.

One of the Inspectors now observed that this amounted practically to getting money by false pretences. It was a case of deliberately "hoodwinking" the Local Government Board; and he asked the Gas Engineer if he thought that what had been done was of a straightforward character. Mr. Humphrys replied that he had not considered it in that light. The Mayor (Mr. F. P. Sudbury) promised, at the request of the Inspector, to bring the matter before the Council.

The Inspector remarked that obviously, if inquiries were to be treated in this manner, they would be useless. He called for the production of the minutes, which were forthcoming, indicating the names of the members of the Gas Committee who were present at the meeting when the decision was arrived at to alter the plans in favour of the erection of a spiral-guided holder.

Subsequently the Inspectors, accompanied by the Town Clerk, visited the gas-works and other parts of the district coming within the scope of the inquiry.

Spiral-Guided Holder to be Re-Erected.

Whatever may be the outcome of the official references to the alleged tergiversation of the Gas Committee, those who are responsible for the control of the gas undertaking have adhered to a consistent policy regarding the type of holder upon which reliance is again to be placed. The disaster has not impaired their confidence in the efficiency, under proper structural conditions, of spiral-guided gasholders. At the Coroner's inquiry last year, which preceded the more exhaustive investigation conducted by Mr. A. G. Drury, one of the Engineering Inspectors of the Local Government Board, Mr. Humphrys was unequivocal in his commendation of holders of this character, on the score of their steadiness. He expressed his preference for them over column-guided holders, particularly under conditions of high atmospheric pressure; and it may be recalled also that Mr. Samuel Glover, while criticizing the position of the tank in this instance, was of opinion that there were circumstances under which he should certainly favour the adoption of these holders. Moreover, the Committee were encouraged by the fact that spiral-guided holders were already in use, and had afforded satisfactory proof of their reliability in the neighbouring Derbyshire towns of Long Eaton, Langley Mill, and Belper.

The mistake, however, at Ilkeston, as was demonstrated later, was in placing the tank above ground. Had the brick and puddle tank, originally proposed, been constructed, there is no reason for supposing the catastrophe would ever have occurred; but the Committee, altering their plans at the eleventh hour, embarked upon a course which, while it was supposed to be in the interest of greater safety, actually had the effect of introducing an element of danger. The ostensible reason given for the change was the fear of adjacent colliery workings undermining the tank if placed underground. In the new works which are now in progress, however, there is to be no repetition of this error; for, in accordance with the original intentions, there is to be a tank of brick and puddle, work in connection with which operations has been in progress since November last. The site has been changed—a more suitable one having been chosen at a spot 400 or 500 yards from where the holder formerly stood.

When the tank has been completed, as it is expected will be the case by June next, the holder, for the erection of which Messrs. C. & W. Walker were responsible, will be reinstated bodily—this being rendered possible by the fact that at no vital part was it very seriously damaged. When the inner lift came down, the holder at the point at which it touched the ground was "dinged" on one side, and the bottom curb was bent beneath; but it was a proof of the strength of the material employed that there was no fracture of the holder, though, under the heavy strain imposed. Subsequent examination also showed, more particularly from the condition of the top of the inner lift, that there was no explosion in the holder itself. The materials, therefore, being in a fit condition for the most part to be again utilized, the reconstruction process is to be undertaken under the supervision of Mr. Samuel Glover, who, it will be remembered, was called into consultation after the disaster, with Mr. J. Ferguson Bell, of Derby. The preliminary work connected with the tank is already in a forward state—the excavations having reached the bottom; and it is hoped that the holder will have been re-erected in time to be brought into use next winter.

GAS PROFITS AND THEIR APPROPRIATION.

Address by Mr. Henry Woodall.

Presiding at a lecture given in the Llandudno Town Hall on Monday night last week, on "The Science and Practice of Modern Gas Heating," Mr. Henry Woodall, who is a resident in the town, made the following remarks on the appropriation of gas profits.

In the beginning, God said "Let there be light." In these latter days, our legislators and councillors say: "Let us put limits on the use of light; let us tax it." Such, indeed, has been the folly of our rulers within my personal experience, that I could imagine them exploiting this, the first necessity of life, by placing the town under a pall, and refusing to let "heaven peep through the blanket of the dark," except at so much per superficial foot. "Too preposterous!" you exclaim. But listen, and learn how nearly (and not long ago) they reached this topmost height of the ridiculous. In my youth, I remember a Government agent going upstairs and downstairs, counting the number of windows upon which a tax could be levied; and I remember too that in those days many windows in all directions were bricked or boarded up, by which device the destroying angel of darkness was appeased, and went his devastating way.

A dreadful figure this of ignorance and folly in high places. But are we much more enlightened to-day? I say, "No!" for I contend that the conduct of affairs in relation to artificial light—and in the term I include heat—in our municipalities is but little removed from that I have described; and I will endeavour to illustrate my point by reference to Manchester. I deal with Manchester because the mischief I mean to expose had its beginning there, where for fifty years or more extravagant duties have been levied upon the users of gas, which have aggregated to a sum that cannot fall short of two million pounds. And this in Free Trade Manchester! Now we all know much can be said, and is said, by Protectionists in favour of their notions; but who was ever bold or cracked enough to orate in support of a tax which should be levied by one section of townsfolk against another section dwelling in the same town? Yet this is what Manchester has been doing in broad daylight for half-a-century; yea, and the tax has been levied upon an article of prime necessity, and to the admiration of many other municipalities who have copied and improved upon the example. That it should ever have been tolerated for one single year is a sad reflection upon the sluggish character of our citizen population.

Let us suppose now that the Corporation, having succeeded, from their standpoint, in exploiting gas, had resolved to go a step further in the direction of Protection, and, having acquired all the abattoirs, had proceeded to levy a tax of 1d. a pound on beef and mutton. Imagine the outcry then! Fire-eyed fury now takes the place of inertness; and the promoters of the scheme are immediately hurled from power. But why? Beef and mutton are not articles of such prime necessity as light and heat; for bounteous Nature would still provide in a hundred different ways the needs of life were the ox and sheep withdrawn from

our markets altogether. Yet the tax levied upon light and heat by a corporation is commonly 10 per cent. or more upon the cost; and 1d. a pound on meat bears but the same proportion. Where is the difference between one tax and the other? Clearly there is no difference in principle; and in practice a tax on beef would be the lesser evil.

Why, then, is the tax on light persisted in? "Well," say its apologists, "you see the amount is returned to the public in the form of a reduced district or other rate." Now, were this quite true and equitable, it would be very silly; and the more equitable the distribution the sillier the process becomes, for to take money from one pocket to place it in another can make no possible difference, except that in corporation or other account-keeping it occasions some complexity, which is at all times objectionable. No, the mischief is that the money taken from the gas or electricity user is not, and never can be, returned equitably by subsidies from the rates; and in practice it will be found that the largest gainers by the system are those who contribute least to the fund distributed.

Take the large warehouse for example. It covers a wide area, and its rateable value is fixed, let us say, at £1000; but there is little occasion for the use of artificial light. Round the corner there is a working printer, confectioner, whitesmith, or other tradesmen, who is rated at £200. To each of these the gas committee lends a talent in the shape of a meter. The former, so to speak, wraps his talent in a napkin and buries it. The latter puts it to continual use, and from early morn until the day is over he makes it contributory to his employment. Mark now what follows. In the parable of the talents it is the idler who is contemned, and from whom is taken away "even that which he had." But in the practice of the corporation, the warehouseman, rated at £1000, who uses (say) 200,000 cubic feet of gas, receives, at 3d. in the pound on his rates, £12 10s., and pays, at 3d. extra per 1000 cubic feet of gas, £2 10s., and is thus a gainer of £10 per annum. On the other hand, the working tradesmen pays the tax of 3d. on a million cubic feet of gas, equal to £12 10s., and receives back in reduced rate 3d. in the pound on £200, or £2 10s., and is thus a loser of £10 per annum—the difference between the two cases being £20. The system is thus seen to be grossly inequitable and unrighteous. Suppose now that sixty years ago Manchester had pursued the sounder policy of giving gas profits to gas consumers. Is it not palpable that all producers, municipal and other, would have been constrained to follow suit, and that the general price throughout the country would have been considerably lower than it is—that the inventiveness of to-day would have come a generation earlier, and that all the refinements we are beginning to appreciate would have played their beneficial part and contributed to the nation's well-being?

And now, in all sincerity, I am going to say something which many may regard as extravagant, and it is that if our corporations are to dispense subsidies at all, it would be far more politic to reverse the present practice, and levy a higher rate, to the relief of the cost of lighting, heating, and power. At the present time, I see no reason why gas should not be sold in Manchester at 1s. 6d. per 1000 cubic feet, and a subsidy of 3d. just for a few years (five at most) would result in such a development in the use of gas as would enable the Corporation permenantly to supply at 1s. 3d., or less, without further resort to rates. This would only be giving back to the users a tithe of what has been requisitioned from them; and I feel sure the end would justify the means. At Sheffield, where the supply is in the hands of a Company, the price is only 1s. 3d.; and at Widnes, under a Corporation, it is even less.

The mention of Sheffield, brings to my mind an interesting comparison. Thirty years ago—1883—the price of gas in the town was 4d. per 1000 cubic feet higher than in Leeds, where I was engineer. At that time, and throughout the period of my management, the Gas Committee pursued the policy which I inaugurated, and which I continue to advocate. During eight years the price of gas fell from 3s. 6d. to 1s. 8d. per 1000 cubic feet on the gross sales. But shortly after I left Leeds, the Corporation adopted the Manchester system; and to-day Sheffield undersells Leeds by 9d. per 1000 cubic feet; and so the gas consumers of Leeds are at a disadvantage of about £130,000 per annum, subject, of course, to the concession on rates, meter-rent, and whatever else. But when all allowances are made, I imagine that Leeds will shine as an illuminating example of how not to do it. And there is this outstanding fact to confront her, that the price of gas to-day is higher than it was thirty years ago; and I think that is an accusation which cannot be brought against any other town in Britain. Clearly the policy is to blame.

Sheffield, on the other hand, can point to wonderful benefits flowing from the low price. You may remember that about four years ago there was a meeting of Sanitary Inspectors in the Pavilion here, when it was shown that Sheffield was casting off her pall of smoke, and could even then boast of longer hours of direct sunshine than Bettws-y-coed.

I have nothing more to say about Manchester except that, under the awakening discipline of Parliament and expert advice, she is seeing the wickedness of her past, and is already showing signs of improvement; very important concessions being proposed. May every prosperity attend her.

I now come home to Llandudno, where the evils which I have inveighed against are as rampant as in any place I know. Here the price of gas is 3s.; and it ought not to exceed 2s. 6d. Here the hard-working tradesman is taxed for the benefit of those who contribute nothing to the fund distributed. Here the chimneys often belch forth their columns of smoke, to the discredit of the place as a health resort, and to the distress of every housewife; and here the gross evils attending the use of coal—ashes, dust, labour, and other concomitants—are being fostered by the policy pursued by the Council.

I conclude my remarks with an example of the hardships inflicted on trade by the system. A company rated at £3880, uses 260,000 cubic feet of gas. They receive out of lighting profits 6d. in the pound on £3880, or £97, and they pay on 260,000 cubic feet of gas, at 6d., £6 10s.; so that they gain £90 10s. A tradesman pays on 1,030,000 cubic feet of gas, at 6d., £25 15s., and receives on his rateable value, at 6d. in the pound, £6 8s.; so that he loses £19 7s. It will be perceived that I take a tax of 6d. per 1000 cubic feet of gas as exactly equalling 6d. in the pound on the rates, which is quite near enough.

SALFORD CORPORATION GAS UNDERTAKING.

Important Concessions to Consumers.

At the Meeting of the Salford Town Council last Wednesday, Alderman Phillips, the Chairman of the Gas Committee, moved that, after the reading of the meters for the quarter ending the 31st prox., the price of gas to all consumers by ordinary meters should be reduced by 2d. per 1000 cubic feet, and that further reductions should be made to consumers of 2 million cubic feet and upwards per quarter—viz., 2 million and under 4 million cubic feet 1d.; 4 to 6 millions, 2d.; 6 millions and upwards, 3d. Alderman Phillips said these concessions would mean a loss of £10,728; and the resolution had the unanimous approval of the members of the Gas Committee except himself. Personally, he thought the Council would be well advised to sanction a smaller reduction.

Sir William Stephens congratulated the Committee on the scheme, but at the same time he thought some attention ought to be paid to Alderman Phillips's statement. Would it not be better to sanction a reduction of 1d., with the provision of another reduction of a like amount later? [No, no.] The Council would look foolish if, after reducing the price of gas by 2d. per 1000 cubic feet, they had to increase it by 1d. He moved an amendment embodying his suggestion.

The resolution was carried; the amendment failing to find a seconder. The Council then, without any discussion whatever, passed a resolution that after the 31st prox. the quantity of gas supplied through prepayment meters for 1d. should be increased from 30 to 35 cubic feet.

Alderman Phillips moved a resolution recommending reductions for the hire of gas-cookers ranging from 3d. to 1s. per quarter according to size. He said he was not going to criticize Manchester for the policy of providing cookers free of hire; but he thought it was wrong. About £204,000 had been absorbed in cookers in Manchester. There were 737 million cubic feet of gas consumed; and the Corporation had to meet interest, sinking fund, and other charges. In Manchester, 58,000 gas-cookers were used by 170,000 people. Salford had 6000 cookers in use among 70,000 people. To be equal in proportion to Manchester, the figure for Salford would have to be 17,500 more than at present. The expense of purchasing and fixing a cooker could be taken at about £4; so that the cost of supply and fixing 17,500 would be £70,000. If they had them, they would have no assurance that the cookers would be used. If people could get them without paying, they frequently did not use them; and he had information from one authority to the effect that until a charge was made the undertaking in question was not a success.

The resolution was carried; an amendment for the supply of free cookers being defeated.

ILLUMINATING POWER AT PERTH.

The following report was prepared by Mr. David Vass, the Engineer and Manager of the Perth Gas-Works, in connection with a notice of motion given for last week's meeting of the Town Council that the illuminating power of the gas should be raised to the minimum of 26 candles.

The minor point to consider is the effect which such a change would have on consumers' fittings. With the exception of the old-fashioned flat-flame burner, all gas appliances for incandescent lighting or for heating or cooking or motive power require to be adjusted to suit the quality of gas which is to be used. A variation of even 1 or 2 candles gives rise to serious inconvenience; and to supply 26-candle gas for half-an-hour on any evening, would cause all incandescent mantles to get clogged-up with soot, and a similar effect would be produced on gas-engines and gas-fires, &c. Gas consumers would have considerable difficulty in obtaining burners adjusted to burn 26-candle gas, and would in many cases have to revert to the old extravagant flat-flame burner. The main point, however, which affects the whole question is that, while a change from 16 to 26 candle power would increase the lighting value of the flat-flame burner 62½ per cent., the heating value of the gas would only be increased by about 20 per cent. But we must consider the cost of obtaining this increased efficiency.

In order to supply 26-candle gas, we should require to revert to the use of first and second-class cannels entirely for the production of all the gas manufactured. This would incur an additional expense of at least 15s. per ton of coal used; and there would also be a loss in revenue to the extent of 3s. 6d. per ton of coal used on account of the coke produced from cannel coal being less in value as a fuel than the coke now produced. These two items alone mean an extra cost of £20,000 per annum, or 1s. 10d. more per 1000 cubic feet—thus increasing the selling price of the gas to 4s. 7d. per 1000 cubic feet for ordinary domestic purposes, or an increase of 66 per cent. So that, while the user of the flat-flame burner would not lose much by the change, the user of incandescent burners, and all persons using gas for cooking, would require to pay an increase of 66 per cent. in order to obtain an increased value of 20 per cent. on each 1000 feet of gas consumed. In the case of users of gas-engines, and for other industrial purposes, the increase of 1s. 10d. per 1000 cubic feet would be equal to more than double the present price—*i.e.*, an increase of 105 per cent. for an increased value of only 20 per cent. on each 1000 cubic feet of gas used.

I should, perhaps, explain the terms 16 and 26 candle power. A 26-candle power gas means that 5 feet of the gas burned under certain fixed conditions as to temperature and pressure will give a light which is 26 times the power of a standard candle; and in the same manner a gas which gives 16 times the power of a standard candle under the same conditions is termed 16-candle gas. But it is not generally understood by the average gas consumer that a flat-flame burner using 8 feet per hour of 16-candle power gas will give an illuminating power of 26 candles. In other words, 8 feet of 16-candle power gas are equal to 5 feet of 26-candle power gas; and for comparison of the relative values of the

two qualities of gas, I take the number of hours' burning which would be obtained for 1s.

	Illuminating Power.	26-Candle Power Gas at 4s. 7d. per 1000 Cubic Feet.		16-Candle Power Gas at 2s. 9d. per 1000 Cubic Feet.	
		Quantity —		Quantity —	
	Candles.	Per Hour. Cubic Feet.	For 1s. Hours.	Per Hour. Cubic Feet.	For 1s. Hours.
Three flat-flame burners	78	15	14 54	24	15·15
One inverted incandescent burner	78	3	73	3·6	101
One upright incandescent burner	78	3·3	66	4	91

I am confident that the effect of such a step would be that we should lose the greater part of the business done in gas-engines and for industrial purposes. and that gas-fires would be abandoned ; and I am well within the mark when I say that our output of gas would be reduced by 50 per cent. The profit on the business would then only be able to meet one-half of the standing charges for interest, &c., which amounts to fully £13,000 per annum ; and it would be necessary to levy a contingent guarantee rate on ratepayers, whether they are gas consumers or not, of about 8d. per pound, in order to raise a sum of £6500 per annum to meet the deficiency, or to raise the prices of gas another 1s. 1d. per 1000 cubic feet, with the risk of further loss of business.

HULL GAS AND WATER SUPPLY.

Annual Report of the Corporation Water and Gas Engineer.

Mr. C. B. Newton, M.Inst.C.E., the Water and Gas Engineer of the Hull Corporation, has presented to the Water and Gas Committee his report for the year ended the 31st of December.

Taking gas first, Mr. Newton states that during the year the usual periodical tests were made by Mr. M. D. Penney, F.C.S., the Corporation Gas Examiner, to ascertain the illuminating power of the gas supplied by the two Companies, with the following results : That of the British Company's gas averaged 15·5 standard candles, compared with 15 candles prescribed ; that of the East Hull Company's gas being 15·03 candles, against 14 candles prescribed. In May last, the Board of Trade authorized the use of the "Metropolitan" argand No. 2 burner by the British Gaslight Company, Limited, in lieu of Sugg's argand No. 1 burner, for testing the illuminating power of the gas supplied by the Company at their Hull station. The East Hull Company were authorized to use the first-named burner under powers contained in their Provisional Order of 1908. Mr. Newton gives the following statistics relating to the gas supply in the three statutory districts into which Hull is divided—Mr. John Young, Engineer and Manager of the British Gaslight Company, Limited, and Mr. D. Wood, Manager and Secretary of the East Hull Gas Company, having favoured him with the particulars of their respective undertakings.

Particulars.	Corporation, O'd Town District.	British Gas Company's District.	East Hull Company's District.
Gas supplied, cubic feet	90,923,000	1,517,658,000	327,036,000
Coal and equivalent carbonized, tons	—	142,761	23,636
Number of consumers—			
Ordinary meters	1,354	19,142	3,217
Prepayment meters	373	28,159	7,861
Length of mains, miles	6½	175	61¾
Number of public lamps	371	4,145	1,407

The quantity of water pumped from the wells last year was 4,370,210,000 gallons, of which 2,090,050,000 gallons came from Springhead and 2,280,160,000 gallons from Cottingham. The figures for 1911 were : Springhead, 1,880,680,000 gallons ; Cottingham, 2,218,540.000 gallons—total, 4,099,220,000 gallons. The following are particulars of the average daily supply : For all purposes, 11,970,000 gallons ; in bulk, 118,000 gallons ; within water limits, 11,852,000 gallons ; by meter, 2,954,000 gallons ; domestic and unmetered trade supplies, 9,318,000 gallons. The quantity supplied per head per day within the water limits last year was 40·26 gallons, of which 31·66 gallons were for domestic and unmetered trade supplies.

METROPOLITAN WATER BOARD.

Cause of the Deficiency in the Water Fund.

In view of the decision of the Metropolitan Water Board to make precepts on the contributory authorities under the Metropolis Water Act, 1902, the Chairman of the Finance Committee (Mr. A. H. Tozer) recently issued a memorandum dealing with the deficiency in the water fund.

The causes of the deficiency are explained to be the diminution in the rate of increase of consumers arising from the depression in the building trade, the movement of population into districts beyond the area of supply, and the increased number of empty houses. Then the Finance Act of 1910 seriously reduced the rateable value of licensed premises ; and the Board sustained an approximate income loss of £17,000 per annum from this class of property. Moreover, the recent quinquennial revaluation of the Metropolis disclosed a great shrinkage in the rate of increase over the previous quinquennium ; it being only 2·83 per cent., compared with 9·29 per cent. in 1906 and 10·76 per cent. in 1901. Then there were losses of income due to the sinking of private wells. A recent report to the Corporation of London shows that in the City alone there are no less than 48 of these wells ; and there are others in different parts of the Metropolis. It is estimated that no less than £32,800 per annum is lost in this way. Moreover, there are in addition a number of premises at which a private well is in existence, but which have a stand-by supply from the Board. The number of such supplies at present afforded is 63 ; representing a total rateable value of £266,942, which in the ordinary way would bring in an income of £10,678 a year. Of this sum the Board obtain by agreement a minimum charge at the rate of one-fourth, or £2669 per annum. It will be seen, therefore, that the loss of income in respect of these stand-by supplies (unless, of course, there is a failure of the private supply necessitating the use of the Board's water) is about £8000 per annum. In other words, the Board lose over £40,000 a year owing to the existence of private wells. With regard to expenditure, rates and taxes have increased by no less than £83,296, or more than 24 per cent. since 1903-4 ; and interest, dividends, and annuities by £46,397. Compared with the £40,652 which the Water Companies in their last year contributed to sinking funds, the Board during 1911-12 set aside £82,752 towards the redemption of debt.

Attention is called by Mr. Tozer to the fact that all the causes of loss of income indicated are absolutely beyond the control of the Board. In matters which are within their control, however, it is claimed that great economy has been effected. The total cost of the staff on the active list under the Companies in 1904 was £181,205, compared with £151,662 incurred by the Board at April 1, 1911. Even by adding £10,630, the cost of management of the "B" stock by the Bank of England, to the Board's figure, there is still shown a saving of £18,913, which is equivalent to 9d. per service, notwithstanding the fact that the number of supplies prior to the transfer was 987,033, compared with 1,109.564 on April 1, 1911. In other words, though the volume of the Board's business had increased 12·41 per cent , the expenditure in salaries and for the management of the "B" stock had been reduced to the extent of 10·44 per cent.

The conclusion arrived at is that "there is no possibility of equilibrium between receipts and expenditure being attained in the near future, but that deficiencies will occur for many years to come." Down to March 31, 1912, they amounted to £209,572, or an average of £52,393 a year. Mr. Tozer says the Board have done, and are doing, their utmost to maintain in a high state of efficiency the vital public service which has been entrusted to them ; and he submits that, in spite of the largely increased expenditure placed upon them, and the other adverse circumstances which are quite beyond their control, "the water supply now costs the public, on the average, less than was the case under the Companies' administration."

At the meeting of the Board on the 7th inst, Mr. Tozer, referring to the statement which had been made that the Local Government Board Auditor had decided that the amount of the deficiency was not leviable from the various Borough Councils, said the Auditor had authorized him to say that this opinion had never been expressed by him ; and he would go further, and personally say that he would hardly challenge the legal right of the Board to issue the deficiency rate.

COLNE VALLEY WATER COMPANY.

The Half-Yearly Meeting of this Company was held on the 4th inst., at the Charing Cross Hotel—Mr. C. E. Keyser in the chair.

The notice convening the meeting having been read by the Secretary and General Manager (Mr. C. P. Sinclair), the Chairman moved the adoption of the report, some particulars from which were given on Jan. 28 (p. 342). He said the water-rates for the half year to the 31st of December came to £27,122 : the amount for the corresponding period of 1911 being £26,720. The increase was therefore £402. Adding that for the first six months of the year—viz., £1348—the total increase for 1912 over 1911 was £1750, which was rather less than for the past few years. The first half of the year was fraught with labour troubles ; and, as a result, great dislocation of building operations ensued. The amount received for building supplies was £546, which, added to the £492 in the first six months, gave a return for the year of £1038. As to the new supplies, 417 were added to the books during the half year, estimated to yield a water-rental of £1213 ; making, with the preceding half-year's number, a total for the year of 868, producing in water-rates an annual return of £2374. The total number of supplies in the Company's district now amounted to 21,350 ; and the population was estimated at about 118,000. The expenditure on revenue account in the past six months amounted to £9779, against £9883 for the corresponding period of 1911, showing a decrease of £104, notwithstanding the fact that in every direction the cost of materials had risen as much as 20 per cent. The result, he was sure, would appeal to the stockholders, and witness to the economical, though perfectly efficient, management of the undertaking. The water supplied for the year exceeded the quantity delivered in 1911 by 7 million gallons ; and the average per head of the population was 27 gallons. The cost of maintenance and management per million gallons pumped was £17 10s., and of the gross income just over £37 per cent., both of which figures were below the average. With regard to the plant, the Company's Consulting Engineers (Messrs. John Taylor, Sons, and Santo Crimp) reported that it had been maintained in a condition of full efficiency ; and the engineering staff, under the Resident Engineer (Mr. J. Blackburn), took a "worshipping interest" in keeping the splendid machinery in first-rate order. As to the quality of the water, Drs. Thresh and Beale's latest report testified to its satisfactory character. The Chairman having given particulars of extensions of the plant, the motion for the adoption of the report was put, and, after some conversation, carried unanimously. The dividends recommended were declared, the three retiring Directors and Auditor were re-elected, and the proceedings closed with the customary votes of thanks.

Bromsgrove Gas Company.—After paying interest on debenture bonds, the year's trading of the Bromsgrove Gas Company shows a profit of £2262, which, with the balance of £1540 brought forward, makes a total disposable balance of £3802. Out of this, it was agreed at the annual meeting to pay dividends for the year of 10 per cent. on the original shares and 7 per cent. on the "B" shares, less income-tax—leaving a balance of £1683 to be carried forward. The mains have been extended to Rubery—a step which it is confidently anticipated will prove remunerative.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Arbroath.—The outcome of the visits of the Gas Committee with Mr. Young, the Gas Manager, to Dundee, Glasgow, and Perth, has been the placing of an order with Messrs. R. & G. Hislop for a setting of 24 vertical retorts on the continuous and intermittent principle invented and patented by Mr. Alex. Wilson, of Glasgow. This contract includes retort-house, coal-elevating plant, coal and coke bunkers, coal-breaker, and coke-handling plant. The total cost, including foundations and connecting-up of the present plant, which forms a separate contract, is £15,565. The Committee examined the Perth horizontal machines, and compared these with the Glasgow verticals; and they unanimously recommended the Council to adopt the vertical system. The matter was brought before the Council on Monday, and was passed without any discussion whatever.

Brechin.—The Brechin Gas Company want £32,500 for their undertaking; but the town offer only £32,000. The proposal of the Company has been laid before Mr. Yuill; and he points out that it would mean a capital of £34,000 and an annual interest of £2210, which was more than the earning capacity of the concern. It was decided not to adopt the Act, on the motion of Mr. Gordon.

Bridge of Allan.—The Council have approved of a report by a Sub-Committee in favour of taking over the control of the gas-works, but are awaiting a final report and recommendation which is to be supplied. At a later meeting of the Town Council, on the motion of Provost Turnbull, the members unanimously decided that the gas undertaking should be acquired by the Council in the interests of the Burgh, and that a meeting of the electors should be called to discuss the matter.

Doune.—The Town Clerk intimated to the Town Council that he had been offered, on loan, the sum required for the purchase of the gas-works at 3¾ per cent. interest. He was instructed to make arrangements for carrying out the loan. Any money that may be required for improvements on the works is to be raised locally.

Dufftown.—The Town Council are debating the introduction of electric light or gas into the town, and are calling in to their counsel the Managing-Director of the Clyde Valley Electric Power Company, Mr. D. A. Starr, and also the Manager of the Aberdeen Gas-Works, Mr. Milne.

Dunfermline.—At a meeting of the Fife County Council, Mr. Wallace read the following letter from the Admiralty with reference to the two somewhat similar water schemes for the Dunfermline district: "As regards the somewhat similar scheme now being promoted by the Corporation of Dunfermline, it has come to My Lords' notice that the matter is more favourable to the Corporation scheme than to that being promoted by the District Committee. There is no foundation for any such rumours, and the attitude of the Admiralty is now, as it has been all along, one of absolute neutrality." Mr. Wallace said that the Admiralty would require 500,000 gallons of water per day at the Naval Base at Rosyth; and if the price was satisfactory, they were prepared to become guaranteed consumers.

Duns.—Owing to the splitting of one of the plates carrying one of the columns of the gasholder, the supply of gas to Duns was in danger of suspension—three feet depth of water being released from the holder. If it had not been for the exertions of the Manager, Mr. M'Laren, and an extra staff of workmen obtained, who fixed up a temporary wooden erection, the holder would have collapsed, with serious consequences. The gale which caused the breaking of the column has also caused other minor damage in the district.

Edinburgh.—The Sub-Committee of the Cleaning and Lighting Committee have agreed to recommend that the minimum wage paid to the lamplighters should be 25s. and the maximum 27s.; the increments and times being the same as at present.

Greenock.—Mr. M'Leod, the Gas Manager, having recommended the installation of a 2 million cubic feet capacity gasholder, in consequence of the increased demand for gas in the district, it is proposed that a deputation should be appointed to visit a number of gas-works in order to obtain the necessary information.

Hamilton.—The Convener of the Gas Committee referred to the question of the gas supply to Blantyre, and explained that the Town Council of Hamilton could do nothing until some arrangement had been come to between the Ratepayers' Committee and the County Council.

Kirkcaldy.—The immediate commencement of the reconstruction of the gas-works is to be delayed, as by 14 votes to 12 the Council decided to postpone matters for a month until the members had time to examine the plans.

Lanark.—The Town Clerk reported to the Town Council that the Burghs Supply Act of 1876 had been adopted in the burgh in 1907, and was now in force. Mr. Herring's report was also before the Council; and the Clerk was instructed to approach the Gas Company and to open up negotiations for the purchase of the works at a price to be mutually arranged.

Perth.—The question of the illuminating power of Perth gas formed the subject of a spirited discussion at the Town Council meeting on Monday night. In moving that the illuminating power be raised to a minimum of 26 candles, Ex-Bailie Wright said that he considered it was essential that something should be done to see that the quality of the gas was satisfactory. It had been very erratic of late. Councillor Allan, the Gas Convener, in moving the previous question, pointed out that of the candle power of gas in fourteen towns Perth stood third highest. Ex-Bailie Macpherson, in seconding, said that if they were to adopt the motion, it would mean that they would have to throw out about 90 per cent. of their appliances. Ultimately Ex-Bailie Wright withdrew the motion.

Tayport.—The Town Council have arranged to put in a setting of six retorts and make other alterations at the gas-works.

Thurso.—The Local Government Board have called upon the Town Council to provide a larger quantity of water. In the opinion of the Board, there is ample evidence of the insufficiency of the supply; and they have given the Council six months within which to put their affairs in order. Provost Durran said that the supply at present was better than for the past 10 or 15 years, and that the demands of the Crown for an additional supply from Loch Calder were exceedingly high—in fact, they were bargaining for a few thousand gallons of water while millions of gallons were running to waste, and they were bargaining in a manner that few landlords would care to do.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 15.

Sulphate of Ammonia.

The tone of the market for this article has continued dull throughout the week, owing to the paucity of new orders from direct consumers, and values have consequently been barely maintained. The expected large demand from the United States for shipment early this year does not seem to have matured, and the requirements for the Home trade have not been sufficient to affect the position. At the close, the quotations are £14 2s. 6d. per ton f.o.b. Hull, £14 3s. 9d. per ton f.o.b. Liverpool, and £14 6s. 3d. per ton f.o.b. Leith. For future delivery some manufacturers would now forego a premium, but even at prompt prices buyers have shown little disposition to operate, and it is reported that there are dealers willing to sell up to the end of this year at a discount.

Nitrate of Soda.

The market for this material is a little easier, and quotations have been reduced to 12s. per cwt. for ordinary and 12s. 1½d. for refined quality, on spot.

LONDON, *Feb.* 17.

Tar Products.

There is not much alteration in the markets for tar products. On the whole, prices remain steady; and the position looks well for forward. Pitch is still in fair demand, and high prices are being asked for this year's delivery. Benzols are quiet, and contracts are difficult to arrange for forward delivery at present quotations. There is not much new business in solvent naphtha just at the moment. Heavy naphtha is steady, but no new business is reported. Creosote is firm, and good prices are being paid for both prompt and forward delivery. Crude carbolic is quiet, and shows signs of weakening.

The average values during the week were: Tar, 30s. 9d. to 34s. 9d. Pitch, London, 49s. 6d. to 50s.; east coast, 49s. to 49s. 6d.; west coast, Clyde, 48s. to 48s. 6d.; Manchester, 46s. 6d. to 47s.; Liverpool, 47s. to 48s. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 10d.; 50-90 per cent., naked, London, 10¼d.; North, 10d. Toluol, naked, London, 10½d. to 11d.; North, 10d. to 10¼d. Crude naphtha, in bulk, London, 5¼d. to 5½d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d.; North, 1s. 1d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10¼d. to 11d. f.o.b. Creosote, in bulk, London, 3¼d. to 3⅜d.; North, 3¼d. to 3½d. Heavy oils, in bulk, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 11d. to 1s. 11½d. Naphthalene, £5 to £9; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

Although the market has been quiet during the week, there has been no lowering in the value—in fact, it has slightly steadied itself in the last few days. It is reported that actual Beckton is quoted at £13 17s. 6d. Outside London makes are £13 10s.; Leith, £14 7s. 6d.; Liverpool, £14 6s. 3d.; Hull, £14 3s. 9d. to £14 5s.; Middlesbrough, £14 3s. 9d. to £14 5s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a little quieter tone in the Northern coal trade; but shipments are fair for the season, and the prices do not show much movement. In steam coals, best Northumbrians are from about 14s. 6d. to 14s. 9d. per ton f.o.b.; second-class steams are unaltered at 14s.; while steam smalls are easy at 10s. 3d. to 10s. 9d. The collieries have a fair amount of forward trade; and in some cases ask higher prices. In the gas coal trade, the ease is also felt, as the home consumption is now rather less, though the shipments continue full. Best Durham gas coals are about 14s. 6d. to 15s. per ton f.o.b.; second-class gas coals are 13s. 9d. per ton; while for "Wear" specials from 15s. 6d. to 16s. f.o.b. is quoted. The stocks of some of the great companies are not large for this time of the year, when the demand is still heavy, and is influenced by fogs. There is, however, the fact that many contracts are running at prices below those current; and thus companies having such contracts do not now so readily pay current rates for the lesser need they have of additional supplies. On the other hand, there is a very strong demand for Durham coal for manufacturing purposes, and this has its influence on gas coal. Coke is on the whole steady. Gas coke is quiet at 18s. 6d. to 19s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Throughout Scotland the demand for coal of all kinds is of a pressing character; and there is no sign of any slackening. Prices are maintained at a high level; and the activity of the market seems to indicate that a higher level of price may yet be attained in the near future. On Friday, on the Glasgow Coal Exchange, the following were the prices quoted: Steam coal, 13s. 6d. to 14s. 6d.; splint, 15s. to 15s. 6d.; ell, 13s. 6d. to 14s.; trebles, 14s. to 14s. 6d.; doubles, 13s. 6d. to 14s.; and singles, 13s. 6d. to 14s. f.o.b. Glasgow.

The Shipley District Council have decided that the wages of gas inspectors shall be advanced by 2s. a week, making the minimum 30s.; that 2s. 6d. a shift extra shall be paid to men employed on Sundays on the telpher plant at the gas-works; and that the rule regarding time-and-a-half for Sunday work shall be extended to include temporary men in addition to the regular workers.

Growing Business at Glastonbury.

A Local Government Board inquiry has been held at Glastonbury, by Mr. W. O. E. Meade-King, relative to an application by the Corporation for sanction to the borrowing of £4295 for the purposes of the gas undertaking. Mr. D. E. Garlick (the Manager) stated that since the Corporation purchased the gas undertaking a steady expansion of business had taken place; the sale of gas having increased by over 50 per cent. The last loan for meters and cookers sanctioned by the Board was estimated to be sufficient for a period of three years, but had been exhausted in just over two. In the sum now asked for (which was intended to meet the demands of the next three years) provision was made for the laying of mains to certain new property. As showing the success which had attended the policy of the Gas Committee in the supply of cookers free of rental with slot-meters, he mentioned that, out of 1340 consumers on the books at Dec. 31 last, 1050 used gas-cookers. The output last year was practically 29 million cubic feet; and gas was sold at 4s. per 1000 cubic feet, with discounts. The total capacity of the works was approximately 32 million cubic feet. The leakage in March, 1903, when he had taken up his duties at Glastonbury, was 15 per cent. The Corporation had then had the works in their possession for one year and nine months. The leakage last year was 9·7 per cent.

Lisburn Gas Undertaking.—By a majority, the Lisburn Urban Council, at its last regular meeting, adopted a recommendation of the Gas Manager for necessary improvements at the gas-works, at a cost approaching £2000. The report of the Local Government Board Auditor stated that the income from the undertaking for the first completed year under the Council was £9041, and the expenditure £10,206 —showing a loss of £1165. A resolution was carried adopting a recommendation of the Committee for an increase in price from 3s. 4d. to 3s. 8d. per 1000 cubic feet. A member, however, notified that he would at the next meeting move that the resolution be rescinded.

Suffocation of Three Children.—Three children were suffocated at a house in South Grove, Peckham, early last Saturday evening. Between five and six o'clock, Mrs. Graham, the tenant of the house, sent her five children to the bath-room. After some time she went upstairs, and, hearing a cry from the room, she opened the door and found that three of the children, Hilary, aged eight, Robert, aged seven, and Edith, aged three, were lying in the bath dead. The other two were unconscious on the floor near the bath. She took them into a bed-room and tried to revive them; and a constable rendered first aid. The two unconscious children soon recovered; but all efforts failed in the case of the three found in the bath. A doctor who was summoned ascribed death to asphyxia. The water for the bath was heated by a geyser; and it is supposed the children turned on the gas and were overcome. The window being closed, there was practically no ventilation in the room. This matter is referred to on p. 446.

Loss on the Walsall Electricity Undertaking.

The General Purposes Committee, having considered the annual balance-sheet of the electricity undertaking, recommended to the Walsall Town Council that a consulting engineer be engaged to report upon the undertaking, and to advise as to measures which should be taken to ensure its profitable, efficient, and economical working. For a time the Electricity Committee's report and balance-sheet, which were submitted to a private meeting of the Council, were kept out of the Press; but the report has since been issued for publication. It opens with an expression of regret that there should have been a loss on the year's trading of £3853. This is attributed to the coal strike, the increased cost of fuel, and the transitional and incomplete condition in which the alternating plant has been on account of extensions and alterations, in respect of which heavy capital expenditure was partially unproductive of revenue until the full demand arose for which it was designed. The Committee had also ascertained that the Local Government Board required that provision should be made during the ensuing year for clearing off an adverse balance on loans of £3052 representing the cost of superseded plant; but as a result of special representations made by them, the department have since sanctioned a loan of £3000 to be repaid within five years. Dealing in detail with the principal causes of the loss, the Committee state them to be: (1) Excessive consumption and increased price of fuel. (2) Inferior quality of fuel supplied. (3) Inefficient working of the plant from various causes. (4) Increase in capital charges. The Committee express the opinion that the attention of the Council should be concentrated upon the excessive consumption of coal, an increase of £1211 in capital charges, and a loss of £854 in revenue through reduction in the price of current.

Lighting of Lewisham Infirmary.—At the fortnightly meeting of the Lewisham Union Board of Guardians on Monday last week, a report was presented by the Infirmary Committee from a Sub-Committee appointed to consider the question of the lighting of the Infirmary. The Sub-Committee reported that experimental lighting of certain wards had been carried out by the South Metropolitan Gas Company and the South Metropolitan Electric Light and Power Company, Limited, and that having examined the two systems and the various fittings, they were unanimously of opinion that electricity was the preferable illuminant. The Committee accordingly recommended that steps be taken to provide electric lighting throughout the whole of the Infirmary. Mr. A. O. Weeks objected to the gas-fittings being "scrapped." He said the Gas Company had not been asked to put in a price for the supply of gas, the cost of keeping the fittings in repair, or the initial outlay. He had heard that they were prepared to give an estimate for the refitting of the Infirmary with new fixtures for £400. He therefore moved, as an amendment, that the Committee's recommendation be sent back for further consideration. It was, however, lost, and the recommendation adopted.

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Herne Bay Water Company.—At the half-yearly meeting of this Company held last Tuesday, under the presidency of Mr. J. W. Docwra, the Directors reported that the income for the six months ended Dec. 31 amounted to £2928, and the expenditure to £1173. The profit and loss account, including the amount brought forward, showed a sum of £2553; and, after providing for interest on the debenture stock, &c., the amount available for dividends was £2274. The Directors recommended that this should be applied in the payment of 6 per cent. upon the preference stock (£524), and at the rate of 6 per cent. per annum upon the ordinary stock (£913); amounting together to £1437, and leaving £837 to be carried forward. This was agreed to.

Lambeth Public Lighting.—The Lambeth Borough Council, at their meeting last Friday, adopted the estimate of the Lighting Committee for the next twelve months for the lighting of the borough. The amount for gas (lighting and maintenance) was estimated at £13,100. The South Metropolitan Gas Company are responsible for 4077 lamps, and the cost of lighting these was put at £10,005. The Gaslight and Coke Company light 871 lamps, at a cost of £2170; and the South Suburban Company light 272 lamps for £647. The remainder of the amount is expended on incidentals, including about £30 for electric lighting; the Electric Avenue, Brixton, being the only thoroughfare in the borough where this light is used.

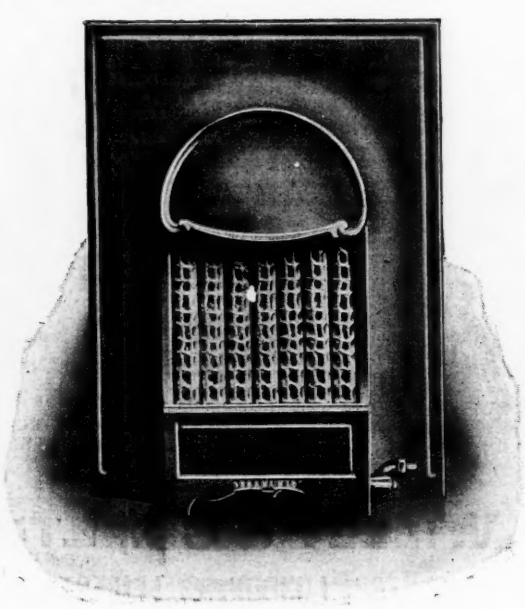
Hyde Water Scheme.—At an inquiry at Hyde, into an application made to the Local Government Board by the Corporation for authority to borrow £3000 to meet over-expenditure on a loan of £8000 granted in 1908, and a new loan of £8000 for mains, meters, &c., it was explained by the Town Clerk (Mr. T. Brownson) that several years ago the Corporation obtained sanction to borrow £11,000 for a water scheme to supply the higher parts of the borough. The actual expenditure to date had been £13,540; and the work still to be done was estimated to cost £459. At the time sanction for the scheme was obtained, about the end of 1908, there was much distress in the town, and the Corporation put some of the unemployed on the work; there being a little over-expenditure on this account. The two reservoirs on Werneth Low had also entailed extra outlay. There was no opposition to the application.

Water Supply and Typhoid Fever at Ottawa.—At the meeting of the Metropolitan Water Board last Friday week, the Water Examination Committee reported that, owing to chronic typhoid fever in the city of Ottawa, the Canadian Government had approached the home authorities with a view to obtaining the best expert advice on the subject. The President of the Local Government Board asked that Dr. Houston, the Director of Water Examination, should be permitted to proceed to Ottawa immediately, with a view to giving advice on the condition of the water supply, to which the trouble had been traced. As the matter was of extreme urgency, the Committee had given the required permission, and Dr. Houston had sailed. After a debate, in which most of the speakers expressed satisfaction that London should be able to render assistance to Ottawa, the action of the Committee was unanimously approved.

Burton-upon-Trent Gas Committee and the Supply of Gas-Fires.—At the meeting of the Burton-upon-Trent Town Council last Wednesday, the Chairman of the Gas and Electricity Committee (Alderman T. E. Lowe) stated that they proposed to enter into a contract with Messrs. John Wright and Co. and the Richmond Gas Stove and Meter Company, Limited, to supply all the gas-fires required for the next two years. With regard to the proposed show-rooms, the Committee had had a number of interviews with the local tradesmen, and had arrived at an understanding which they regarded as fair. He expressed the hope that when the Committee brought forward their recommendations on this matter in a month or two, they would receive the unanimous support of the Council.

Shanklin Gas Company.—The accounts presented at the annual general meeting of this Company last Wednesday showed a sum of £2490 available for distribution; and the Directors recommended the declaration of a dividend at the rate of £5 10s. per cent. for the six months ended Dec. 31 last; making with the interim dividend £5 7s. 6d. per cent. for the year. The Chairman (Mr. F. Cooper), in moving the adoption of the Directors' report, remarked that some good results had followed the use of the retort-charging machine invented by their Engineer and Manager (Mr. Frank C. Taylor). He gave some very interesting figures, showing that in 1878 the Company made 8712 cubic feet of gas per ton of coal, whereas last year 12,202 cubic feet per ton were produced. This large increase was, he said, due to the many improvements made in the plant and works during the intervening years. In 1878 the sale amounted to 6348 cubic feet per ton, and last year to 11,400 cubic feet. In the first-named year, the cost of labour for manufacture was 5s. 0¾d. per ton; last year it was 2s. 5¾d. The price of gas had been reduced on several occasions; and it was now at the comparatively low figure of 3s. 9d. per 1000 cubic feet. The report was unanimously adopted.

Electric Light Failure in Manchester.—The supply of electric light and power failed almost completely in the centre of Manchester on the night of Friday, the 7th inst. About half-past nine, the lights in the greater part of the Market Street area suddenly disappeared. At the electricity station in Dickinson Street, a representative of the "Manchester Guardian" was informed that the officials there could not tell at first how the breakdown had occurred. It was assumed that there had been a fusing of the wires somewhere, or that the electric current had been disturbed by the rupture of a water-pipe. The officials were not long in discovering that the area affected extended so far as the whole vicinity of the Royal Exchange, thence to Corporation Street and Fennel Street, and on to the Cathedral; and shortly after eleven o'clock they managed to discover at least something associated with the breakdown, and linked-up the affected area to other sources of supply. They did not know the precise cause of the failure; but their view was that there had been a fusing of the wires in Mosley Street. The breakdown was of so serious a character that though it did not extend over the whole of the city, it hindered business to a very considerable extent.



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Reductions in Price.—The following reductions have lately been made in the price of gas: From 3s. to 2s. 10d. for ordinary consumers and to 2s. 3d. for power purposes, by the Sleaford Gas Company; from 4s. 9d. to 4s. 6d. by the Knighton Gas Company; and from 2s. 6d. to 2s. 5d. by the Ulverston Urban District Council.

Public Lighting in Birmingham.—Referring to matters complained of by some of their correspondents, a local paper remarks that there are 22,000 lamps under the control of the Birmingham Corporation, exclusive of those for high-pressure gas around the Council House; and there is a permanent staff of 219 lamplighters, besides supernumeraries to be called upon for the work in times of emergency. It is calculated that no less than 140 gross of mantles are used each month; this working out at the rate of about eleven or twelve mantles per burner per annum. The cost of providing the city and suburban streets with gaslight amounts to between £38 and £39 per hour.

Silloth Gas-Purchase Proposal.—It was stated at a meeting of the Holme Cultram Urban District Council, in regard to the proposed purchase of the Silloth Gas Works, that the Local Government Board had refused to sanction the Provisional Order, on the ground that the necessary notice had only been advertised once in the local papers. The Clerk said it was through some misunderstanding between the Parliamentary Agents and himself that the advertisement was only inserted once. The agents had since suggested that they should proceed by Bill instead of by Provisional Order; but one member pointed out that the extra cost would be a serious matter in connection with so small a transaction—the proposal being to purchase the gas undertaking at a cost of £2400. The matter was referred to the Silloth Committee.

Birmingham Gas Committee and the Fitting Trade.—The annual report of the Birmingham Branch of the Gas Fitters' Trade Association stated that an important experiment had been adopted whereby some members of the commercial staff of the Corporation Gas Department were to accompany the fitters for the purpose of gaining an insight into the practical side of the trade; while fitters were also to receive training on the commercial staff. The experiment was made for twelve months. At the meeting, Alderman Jephcott congratulated the men on their success in obtaining an increase of wages from the Gas Committee. Master fitters, if they were going to do work for the Corporation, were now compelled to pay the trade union rate for the district of 9d. an hour. This was important because, by an agreement between the Gas Committee and the master fitters, a large amount of work was given out to private firms.

The Allegation of Irregularities at Limerick.—The Limerick Corporation have adopted the recommendation made by the Whole House Committee in favour of a sworn inquiry by the Local Government Board of Ireland into the irregularities alleged by a Special Committee who investigated the management of the gas undertaking. Mr. Gilligan expressed the view that if the Special Committee had gone to the gas-works in the first instance, and conducted their investigation on the spot, they would have had more evidence than they ultimately obtained. It was agreed that the case to be presented to the Local Government Board should be, in the first instance, submitted to the Law Adviser and to the Gas Committee; while it was arranged that a digest of the Special Committee's minutes should be attached to the case presented, and that the Auditor's remarks on the working of the gas undertaking for the past ten years should also be submitted.

A Co. Dublin Water Supply.—The Local Government Board for Ireland have held an inquiry into the application of Rathdown No. 1 Rural District Council for a loan to provide a water supply for the Co. Dublin residential districts of Goldenball, Bolally, and Sandford. Opposition was offered by several interests. The Solicitor for the Council said the conflict of testimony was as to the source of the new supply. As to the opposition of the Dublin Corporation, he held that this body ought to show they were able and willing to supply water in the districts concerned. But in 1894 they obtained an Act relieving them from all responsibility. As to whether the proposed supply would be within the Corporation limit, Mr. Rice, for the Corporation, said he would like to have time to consider. If possible, something should be done, not only to enable the Corporation to secure a revenue, but to enable the Rathdown Council to obtain a supply at a cheaper price.

Price of Electricity at Lowestoft.—To meet the increased cost of materials and coal, and the decreased consumption of current by metallic filament lamps, the Electric Lighting Committee recommended at last week's meeting of the Lowestoft Town Council that the charge for current for lighting should be increased by ½d. per unit (to 5d.), with 5 per cent. discount for payment in a month. It was stated that the Committee anticipated a deficiency at the end of the year; but they were willing to leave the matter entirely in the hands of the Council. One member remarked that they had been lighting the streets at a loss in order to keep the Gas Company out; and now they proposed to tax the private consumer, the best supporter of the undertaking, which, on its present line of working, was heading for bankruptcy. In reply, it was contended that the gross profits last year were equal to 7½ per cent. on the outlay. The recommendation was sent back to the Committee for further consideration.

The Divining-Rod in Germany.—The Engineering Supplement to "The Times" last Wednesday contained the following communication from Count Carl von Klinekowstroem, of Munich: "I should like to draw the attention of your readers to the society for elucidating the problem of the divining-rod which was founded a year ago, and which has already published several remarkable pamphlets. The President of the Society is Dr. Ing. Robert Weyrauch, the Professor of Hydraulics at the Technical University of Stuttgart. . . . During the last few years, the dowsing-rod has been the subject of serious investigation in Germany, although in contradistinction to Sir William F. Barrett, F.R.S., Professor of Physics at the University of Dublin, we accept it as a physical and not as a psychological phenomenon. The successful experiments which have been made with the divining-rod in Germany, notably in Munich, in seeking for the ruptures of burst water-pipes, have brought us a good step forward in the elucidation of this interesting and complicated problem."

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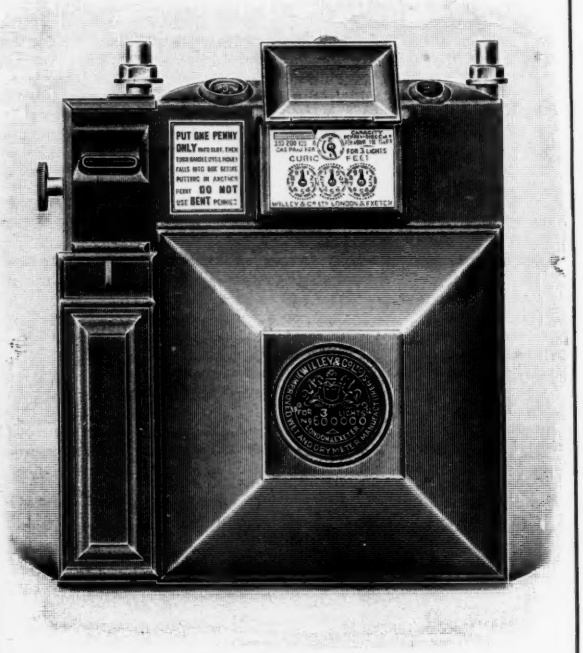

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Gas and Electricity Charges at Carlisle.—The Carlisle City Council have adopted a recommendation of the Public Lighting Committee that the Gas and Electricity Committees be requested to consider the question of reducing the charges for public lighting from the end of the present financial year.

Public Health (Acquisition of Water) Bill.—It may be remembered that the Prime Minister recently stated, in answer to a question, that there was no possibility of the above-named Bill, in regard to which there has lately been some correspondence in the "JOURNAL," becoming law in the present session. Last Friday, the order for the second reading of the Bill was discharged, and the Bill withdrawn.

Exmouth Water-Works.—An inquiry was held at Exmouth last Thursday, by Mr. W. O. Meade King, with reference to an application by the District Council for the Local Government Board's sanction to a loan of £1200 for water-works extensions. Mr. S. Hulton, the Surveyor, explained that the money was required for new mains, those at present in use being inadequate to supply the needs of a rapidly-growing district. Mr. T. Abell, a member of the Council, opposed the application, on the ground that the expenditure was not necessary; but it was said he was the only opponent of the proposal in the Council.

Progress of the Hull Water Undertaking.—It has been agreed by the Hull Corporation Water and Gas Committee to hand £15,000 over to the relief of the rates—the same contribution as last year—and to carry £2615 to the reserve fund. The Chairman (Alderman H. Feldman) explained that the total income for the twelve months to March 31 was estimated at £67,293, and the net profit at £19,803. He thought the public should know of the phenomenal progress of the water undertaking. Since 1901, the Committee had given in aid of the rates £114,000, and had contributed from revenue large sums for new works.

Projected Gas Storage Extensions at Keighley.—The Keighley Town Council have deferred consideration of a scheme for the expenditure of £17,000 on gas storage extensions. The proposals included the acceptance of a tender for the construction of a new gasholder at the Thwaites station. It was stated at a recent meeting that the maximum make of gas under present conditions for three consecutive days had been 5 million cubic feet, while the maximum output had been 6¾ million cubic feet, which left no stock of gas to be drawn upon. At times of stress, additional retorts had been put into operation; but this process, besides being inconvenient, was ruinous to the settings, and considerably shortened their life. It has been generally admitted that extensions are urgently needed.

Loan for the Tiverton Gas-Works.—The Lighting Committee of the Tiverton Town Council brought before that body yesterday week a recommendation that application should be made to the Local Government Board for power to borrow £2900 for gas-works purposes. Alderman J. Thorne, Chairman of the Committee, explained that part of the sum was required for the renewal of old plant, and the remainder for the extension of mains. They had expended £700 in excess of their loans up to Sept. 30 last. A new washer was now required; and in the renewal of mains some would have to be laid of larger size than those now in use. The Manager (Mr. Clark Jeffery) had prepared an estimate showing the cost of the requirements of the undertaking for the next three years; and the money would be borrowed as it was required. The recommendation was agreed to.

Genoa and District Water Supply.—At the statutory meeting of the Genoa and District Water-Works Company, Limited, held in London last Friday, the Chairman (Mr. James Jackson, D.L., J.P.) expressed his pleasure in informing the shareholders that all difficulties had been overcome, and that the Company were on the way to some substantial revenue earning. Capable and efficient representatives of the engineers and contractors were on the spot, streets were being opened-up, pipes laid, and connections with houses established; so that there was an immediate prospect of rapidly increasing the sales of water. Numerous applications for it had already been received. The Municipality had extended the time for the completion of the large service reservoir from six to eighteen months. To sum up, a favourable start had been made, and closer inspection and experience confirmed the view that the Company would prove a sound and profitable enterprise.

Ilfracombe Gas Company.—Mr. W. C. Rafarel presided at the annual meeting of the Ilfracombe Gas Company, which was held on Thursday last. It was reported that, after placing £358 to the reserve fund, there was a balance of £3906 to the credit of the profit and loss account. There had again been an increase in the sales of gas. The price was reduced, and the discounts were increased, as from March 25 last; and the Directors had decided further to reduce the price as from March 25 next. The balance-sheet showed that the receipts from the private sales of gas were £8214, and for public lighting £925. Rentals of meters and fittings yielded £801, and sales of residuals £2433; some smaller receipts bringing the total revenue up to £12,379. The expenditure was £9402, of which £6652 was for the manufacture of gas. The Chairman congratulated the shareholders on the position of the Company, and said the Directors were very pleased to be in a position again to reduce the price of gas by 1d. per 1000 cubic feet. A dividend of 5 per cent. was declared.

Lighting of Shaldon.—A meeting was held at Shaldon last week to consider the question of the lighting of the village. It is proposed by the Teignmouth District Council to lay a main along the bridge crossing the estuary of the Teign, and light Shaldon by gas; the cost being estimated at £3000. The inhabitants had, however, expressed a preference for electric light. Mr. F. W. Knight, the Surveyor to the Council, said they favoured gas because of its cheapness and general utility. Gas cost 3s. 1d. per 1000 cubic feet in Teignmouth; and at this price the cost of a 60-candle power light worked out at 12s. 4d. per 1000 hours, while electric light at 6d. per unit would cost 13s. 9d. per 1000 hours for a 25-candle power light. Mr. J. A. Gray, the Manager of the Gas-Works, pointed to the uses of gas for cooking and heating as well as lighting, and said that for all purposes it compared advantageously with electricity. They had as many as 560 gas-cookers installed in Teignmouth; and he had no doubt that the use of gas for cooking would be similarly appreciated at Shaldon when introduced. In the end, a resolution was passed re-affirming the decision of the previous meeting in favour of electric lighting. JW

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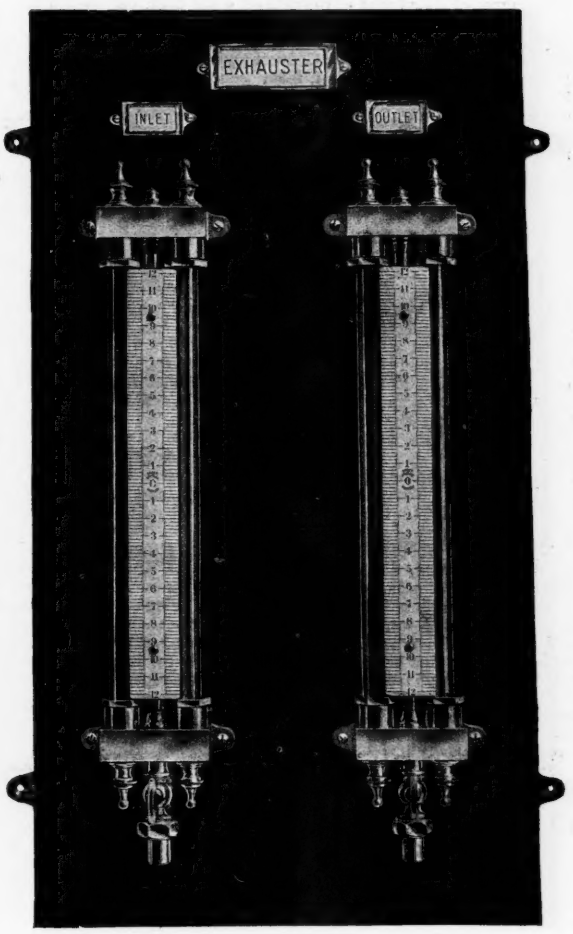

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Telephone Nos. { 3289 (City) MANCHESTER. 2025 (Central) NOTTINGHAM.

Wires { "SAWER MANCHESTER." "SAWER NOTTINGHAM."

Electric Wire Dangers.—A Dublin Coroner's Jury have returned a verdict to the effect that Edward Blance met his death through the current of a non-protected electric wire at a motor works. He was engaged putting a motor-car into a garage when a wire hanging from the supply to a lamp came in contact with the brass on the wind-screen of the car. A man named Kinnear, who was assisting, was knocked down; and Blance fell to the ground in an unconscious condition, and died almost immediately. The Jury stated that the wire was not properly protected.

Divining for Water.—The following letter from Viscount Dillon appeared in "The Times" recently: "It has been announced in the papers that an inquiry by a competent committee is to be made as to the practical use of water-finders. May I draw the attention of those interested in such matters to p. 109 of the fourth volume of the professional papers of the Royal Engineers, 1840, wherein is described the finding of water for the Fort Regent, in Jersey, by means of the *baguette divinatoire?* The work was begun in December, 1806, and completed successfully by November, 1808. The divination was performed in the presence of the Lieutenant-Governor (Sir E. Gibbs, K.C.B.), and is described by Major Harry D. Jones, R.E., later Sir Harry D. Jones, G.C.B., Lieutenant-General and Governor of the Royal Military College. Such evidence is irrefutable."

Grantham Corporation and the Water-Works.—The half-yearly meeting of the Grantham Water Company was held last Tuesday week—Mr. J. G. Thompson in the chair. The accounts for the half year showed a balance on revenue account of £3793 in favour of the Company. The Directors proposed that £2000 of this sum should be applied in payment of a dividend at the rate of 5 per cent. per annum for the half year, and that the balance of £1793 should be carried forward. In moving the adoption of the report, the Chairman said there had been a rumour that the Town Council were about to acquire the undertaking of the Company; but, from what he had heard, it was not likely that they would buy it. The Company were not prepared to say "No" if there was any great desire on the part of the Council to purchase. They did not wish to raise an insuperable obstacle. The motion was carried.

Supernumerary Lamplighters and National Insurance.—In the House of Commons last Wednesday, Mr. Wedgwood repeated a question he had put to the Secretary to the Treasury on a previous occasion as to whether the supernumerary lamplighters of the Gaslight and Coke Company were rightly deprived of 4d. a week, out of their wage of 5s. 6d. a week, for the purposes of national insurance. Mr. Masterman replied that correspondence was still proceeding with the Company on the matter, and he added that he thought the question was as to whether the men concerned were rightly insured under the Act. He promised to inform the hon. member later on as to the result.

APPLICATIONS FOR LETTERS PATENT.

2727.—ROLLASON, A., "Carbonization of coal." Feb 3.
2797.—MAUDE, J., "Suction-gas plant." Feb. 3.
2861.—DEMPSTER, R. & J., BEARD, G. F. H., and SCOTT, J. W., "Gasholders." Feb. 4.
2946.—MACLAREN, M. P., "Fittings for direct and indirect lighting in combination." Feb. 5.
2954.—KENT-JOHNSTON, A. G., "Lighting and extinguishing gas-lamps." Feb. 5.
3002.—PHILIP, A., and STEELE, L. J., "Detectors of combustible gases." Feb. 5.
3005.—WORSFOLD, F. J. & J., and SMITH, A. J., "Gas-lamps. Feb. 5.
3010.—ANDERSON, D., "Gas-lamps." Feb. 5.
3035.—TIMM, F. C. W., "Gasification of fuels." Feb. 5.
3052.—TRIST, A. R., "Governing devices." Feb. 5.
3092.—ALEXANDER, C. J., "Inverted burner." Feb. 6.
3114.—BALDWIN, F. E., "Gas-lamps." Feb. 6.
3147.—STETTINER CHAMOTTE-FABRIK AKT.-GES. VORM. DIDIER, "Coke-furnaces." Feb. 6.
3181.—MANSFIELD, E. A., "Locating pipes." Feb. 7.
3253.—BRIDGEFORD, P. S., "Incandescent burners." Feb. 7.
3284.—HILLS, H. G., and THOM, R. W., "Distillation of carbonaceous material." Feb. 8.

GAS COMPANIES' STOCK AND SHARE LIST.

The week just concluded on the Stock Exchange only brought still further depression. Markets are oppressed by the flood of new issues which are being poured upon the public, and which are attractive enough to be formidable competitors with the old-established wares of the markets. Then all factors were hostile—Mexican trouble in the West added to war in the East; labour trouble in the States; Government broken faith to the Railway Companies at home; and tight money. Little wonder, therefore, that prices in general have shrunk. The reopening on Monday—if reopening it can be called, for some markets never quite woke up at all—was of the quietest; and there was hardly any movement in prices. Gilt-edged stocks were quite dull, though Consols were unchanged, Railways were featureless, and American weak. Tuesday was almost as quiet; and the tone was depressed. All markets in general were weak and dull. Matters were worse on Wednesday, with extreme despondency. Government issues were very flat. Consols fell ¼ for money and ⅜ for account. Rails had prices lowered, and American were weak. Thursday was very heavy at first, but effected a partial recovery later. Consols were ¼ lower; but in Rails some lines were better. Things had a moderate improvement; and—an unusual Friday feature—there was less pressure to sell. Government issues revived somewhat, and Consols picked up their lost ⅛. Other markets also were firmer. Saturday was deadly quiet; markets being generally unchanged and devoid of further feature. Consols closed at 74⅛ to 74½—a fall of ⅛ in the week. In the Money market, there was a strong demand for the first half of the week, and rates stiffened; but the tension somewhat relaxed later. Business in the Gas Market was unusually small. The aggregate of transactions was far below the normal average; and these were confined to few undertakings. The tone, too, was not so uniformly strong as has ruled of late; one or two important concerns being fractionally easier. In Gaslight and Coke issues, the ordinary was done at 106⅛ to 107¼ *cum div.*, and from 102¾ to 104½ *ex div.*—a fall of ½. In the secured issues, the maximum was ¼ lower at 81¼ *ex div.*, and the preference marked from 100 to 101¾ *cum div.* and 99½ *ex div.*—a fall of 1. South Metropolitan realized 116½ and 117 *cum div.*, and from 113⅛ to 115 *ex div.*—a fall of ¼. The debenture changed hands at 75¼. Nothing was done in Commercials. Among the Suburban and Provincial group, Alliance and Dublin was marked at 78, Brentford preference at 116½, British at 45⅛ and 45⅜, Tottenham "B" at 114¼ and 114¾ *ex div.* (a rise of ⅞), ditto debenture at 94, and (on the local Exchange) Sheffield "C" at 232—a rise of 2. In the Continental companies, Imperial was very quiet, and changed hands at 173 to 175, Union realized 85 and 86, European from 18⅜ to 19, and Tuscan debenture 97½ and 97¾. Among the undertakings of the remoter world, Primitiva was done at 6 1/16 and 6⅜, ditto preference at 5 5/32 and 5 5/16, ditto debenture at 96¼, River Plate debenture at 93½, and South African at 10¼ and 10½.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	75—80	..	6 5 0
374,000	,,	Jan. 16	4	Do. 4 p.c. Deb.	83—86	..	4 13 0
280,000	5	Oct. 11	7½	Bombay, Ltd.	6½—7	..	5 7 2
50,000	10	Aug. 29	15	Bourne-mouth Gas and Water	10 p.c. B 7 p.c. Pref. 6 p.c.	..	29—30 .. 5 0 0 / 15⅞—16¼ .. 4 6 2 / 14—14½ .. 4 2 9
832,000	10	,,	7				
75,000	10	,,	6				
880,000	Stk.	Aug. 14	14†	Brentford Consolidated	265—270	..	5 3 8
830,000	,,	,,	11†	Do. New	205—210	..	5 4 9
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—117	..	4 5 6
206,250	,,	Dec. 12	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
217,380	Stk.	Aug. 29	11	Brighton & Hove Orig.	210—215	..	5 2 4
244,200	,,	,,	8	Do. A Ord. Stk.	153—155	..	5 3 3
530,000	20	Sept. 27	12½	British	44½—45½	..	5 9 11
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	90—91	..	4 7 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	92—94	..	4 5 1
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	3½—4½	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	71—75	..	6 0 0
157,150	Stk.	Feb. 13	5	Chester 5 p.c. Ord.	107½-109½*	..	4 11 4
1,513,280	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Pref.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	102—104	..	5 2 6
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	84—87	..	4 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—132	..	5 6 1
492,270	Stk.	—	5⅜	Derby Con. Stk.	124—125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
1,000,180	10	Jan. 16	10	European, Ltd.	18½—19½	..	5 2 7
16,415,840	Stk.	Feb. 13	4/17/4	Gas light and Coke	4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref.	103—106*	—½ 4 12 9 / 81—83* —1 4 4 4 / 97—99* —1 4 0 10
2,600,000	,,	,,	3½				
4,062,385	,,	,,	4				
4,674,850	,,	Dec. 12	8	Coke	3 p.c. Con. Deb.	75—78	.. 3 16 11
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.		91—93	.. 5 7 6
82,500	,,	,,	6½	Do. do. 5 p.c.		—	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.		16—16½	.. 6 13 4
131,000	Stk.	Sept. 13	7⅝	Ilford A and C		154—157	.. 4 17 1
65,780	,,	,,	6⅛	Do. B		122—124	.. 4 18 9
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.		89—91	.. 4 7 11
4,940,000	Stk.	Nov. 14	9	Imperial Continental		173—178	.. 5 1 1
1,335,000	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.		85—87*	—¼ 4 0 6
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.		122—125	.. 4 16 0

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A	223—225	..	4 8 11
718,100	,,	,,	7	Do. B	161—163	..	4 5 11
806,083	,,	Dec. 30	4	Do. Deb. Stk.	98—100	..	4 0 0
63,480	Stk.	Jan. 16	3	Maidstone 3 p.c. Deb.	68—70	..	4 5 9
75,000	5	Nov. 28	6	Malta & Mediterranean	4½—4⅝	..	6 6 4
250,000	100	Oct. 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	Oct. 30	3⅛	Monte Video, Ltd.	12⅛—13	..	5 7 8
1,775,892	Stk.	July 26	4⅛†	Newc'tle&G'tesh'd Con.	1C2⅛—1C3⅛	..	4 7 0
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	86—87	..	4 0 6
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.	13⅛—14½	..	5 1 5
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	125—130	..	6 3 1
60,000	5	Sept. 27	10	Ottoman, Ltd.	8⅛—8⅜	..	5 14 3
60,000	50	Aug. 14	13	Portsea, Island B	127—130	..	5 0 0
100,000	50	,,	12	Do. C	124—127	..	4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.	6⅜—6⅞	..	5 16 5
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	5—5⅛	..	4 15 3
521,600	100	Dec. 2	4	,, 4 p.c. Deb.	96—98	..	4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92—94	..	4 5 1
275,000	5	Apl. 12	12	San Paulo, Ltd.	13—14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A	234—236	+1	4 4 9
209,984	,,	,,	10	Do. B	233—235	+1	4 5 1
523,500	,,	,,	10	Do. C	231—233	+2	4 5 10
90,000	10	Sept. 27	7½	South African	9½—10½	..	7 2 10
6,429,595	Stk.	Feb. 13	5/9/4	South Met., 4 p.c. Ord.	112⅛—115⅝*	—¼	4 14 7
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	74—77	..	3 17 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	164—166	..	5 2 5
952,795	Stk.	Aug. 14	6†	S'th Suburb'n Ord. 5 p.c.	119—122	..	4 18 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—119	..	4 4 0
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	118—120	..	4 3 4
594,740	Stk.	Nov. 14	5	Southampton Ord.	102—105	..	4 15 3
120,000	Stk.	Feb. 13	7½	Tottenham A 5 p.c. and B 3½ p.c.	139—142*	+⅝	5 2 1
488,940	,,	,,	5⅜		113—115*	+⅛	5 0 0
149,470	,,	Dec. 30	4	Edmonton 4 p.c. Deb.	92—94	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	7⅞—8⅛	..	6 1 3
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
296,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	115—115½	..	4 6 7
255,636	Stk.	Aug. 29	6⅜	Wands-worth B 3½ p.c. 3 p.c. Deb. Stk.	140—143	..	4 16 2
85,766	,,	Dec. 30	3		68—70	..	4 5 9

Prices Marked * are "Ex. Div." † Next dividend will be at this rate.

Charge for Water for Cleaning Motor-Cars.—Referring to this subject recently, the writer of "Up-to-Date Motor Notes" in the "Financial News" said: "In accordance with the practice which has been followed for many years, the Solicitor to the Royal Automobile Club has now perused the Private Bills which have been deposited in Parliament for the 1913 session. In several cases clauses which are inimical to the owners and users of motor-cars have been discovered. In the following districts, powers are being sought to make additional charges in respect of water used for the washing and cleaning of cars: Lymm, Barry, Morley, Heathfield, and Mid and East Kent; and in these cases the Solicitor is in communication with the Agents for the respective Bills with a view to having the clauses suitably amended. The object of the clauses is to override the decision of the High Court in the case of *Harrogate Corporation v. Mackay*, which was fought by the Royal Automobile Club in the interests of motorists, and by which it was established that water used for washing a motor-car kept on private premises was water used for domestic purposes, for which no extra charge beyond the ordinary water-rate could be made."

The lecture at which Mr. Henry Woodall delivered the address to be found elsewhere was given by Mr. Arthur Forshaw, B.Sc., Chief Chemist to Messrs. John Wright and Co., in connection with an exhibition of gas appliances held in Llandudno. Though the audience consisted largely of ladies, there was a considerable gathering of gas-fitters and others, who doubtless obtained some useful information from Mr. Forshaw.

Among the new joint-stock companies lately registered are the following: City of Las Palmas Water and Power Company, Limited, with a capital of £125,000, in £1 shares, to supply the port and town of Las Palmas and the neighbourhood with water and electricity, to acquire the concession granted to Bernardo de la Torre by the Municipality of Las Palmas, Grand Canary, and to adopt an agreement with the Las Palmas Syndicate, Limited, and Bernardo de la Torre. The Dacolight Engineering Company, Limited, with a capital of £50,000, in £1 shares (30,000 preference), to carry on business as mechanical, electrical, gas, heating, lighting, chemical, and metallurgical engineers, electricians, &c., to acquire certain British patents relating to incandescent and other gas-lamps and means of igniting gas-lamps, and to adopt an agreement with D. Anderson.

The fifth annual staff dinner of the Bryan Donkin Company, Limited, took place last Friday week, at the Hotel Portland, Chesterfield. The Managing-Director (Mr. George Clark) presided; and he was supported by two other members of the Board—Messrs. H. J. Donkin and A. G. Webb. The gathering was a large one; and a thoroughly enjoyable evening was spent—an excellent musical programme being provided by the Bryan Donkin Orchestral Society and others. The toast of "The Staff" was given by Mr. Clark, who, in calling attention to his twenty years' association with the Company, gave some interesting statistics as to the output and wages bills—indicating the enormous expansion of the business in all departments. He thanked Mr. Donkin for the valuable *brochure* which he had compiled on the earlier history of the Company. Mr. H. J. Donkin proposed the toast of "The Visitors," to which Councillor Lancaster responded.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

WORKS SUPERINTENDENT. Cheltenham Gas Company. Applications by March 6.
DRAUGHTSMAN. C. & W. Walker, Donnington.
MANAGER. Forres Gaslight Company. Applications by March 8.
OUTDOOR SUPERINTENDENT. Stretford Gas Company. Applications by Feb. 27.
WORKS FOREMAN. Stretford Gas Company. Applications by Feb. 27.
FOREMAN FITTER. No. 5697.
AGENTS (PIPE LOCATOR). F 38, Birchell's Advertising Offices, Liverpool.
DISTRICT FITTERS. Weston-super-Mare Gaslight Company.
SHOW-ROOM ASSISTANT. Brentwood Gas Company.

Appointments, &c., Wanted.

INSPECTOR. No. 5698.
ENGINEER OR REPRESENTATIVE. Gas, c/o W. Porteous and Co., Glasgow.

Plant, &c. (Second-Hand), For Sale.

RETORTS AND FITTINGS, CONDENSERS, &c. Sutton Gas Company.
RETORTS, BENCH FITTINGS, &c., CONDENSERS, SCRUBBER, WASHER, EXHAUSTERS, PURIFIERS, STATION METER, &c. Newport (Mon.) Gas Company. Tenders by March 5.

Patent for Disposal or Exploitation.

MANTLE MANUFACTURE. Haseltine, Lake, and Co., 7 and 8, Southampton Buildings, W.C.
SELF INTENSIFYING GAS LAMP. No. 5696.

Meetings.

BRENTFORD GAS COMPANY. St. Ermin's Hotel. Feb. 21. 2.30 o'clock.
HARROW AND STANMORE GAS COMPANY. Holborn Restaurant. March 3. Twelve o'clock.
HORNSEY GAS COMPANY. 63, Chancery Lane, W.C. Feb. 28. 3.30 o'clock.

Stocks and Shares.

BARNET GAS AND WATER COMPANY. London Mart. March 11.
HARROW AND STANMORE GAS COMPANY. London Mart. March 4.
LOWESTOFT WATER AND GAS COMPANY. London Mart. March 4.
TENDRING HUNDRED WATER COMPANY. London Mart. March 4.

TENDERS FOR

Cookers.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Fire-Clay Goods.

LOUGHBOROUGH GAS DEPARTMENT.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Gasholder and Tank (Also Additions, Resheeting, &c.).

HAVERFORDWEST TOWN COUNCIL. Tenders by March 10.
STOKE-ON-TRENT GAS DEPARTMENT. Tenders by March 13.
WORKINGTON GAS DEPARTMENT. Tenders by March 18.

General Stores (Slot Fittings, Copper, Sulphuric Acid, Lead and Piping, Barrows, Tools, Oils and Benzol, Taps and Cocks).

PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Lighting Goods (Lamps, Fittings, Mantles, &c.).

PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Meters.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Oxide.

BROADSTAIRS GAS COMPANY. Tenders by March 3.

Pipes, &c.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

Purification Plant.

WORKINGTON GAS DEPARTMENT. Tenders by March 18.

Tar and Liquor.

CARLISLE GAS DEPARTMENT. Tenders by Feb. 27.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by Feb. 24.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 5.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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A HISTORY OF THE

INTRODUCTION OF GAS LIGHTING.

BY CHARLES HUNT, M.Inst.C.E.,

Past-President of the Institution of Gas Engineers. Author of "Gas Lighting," which forms the Third Volume of Groves and Thorpe's "Chemical Technology."

As a frontispiece, the book has a photographic reproduction of the portrait of William Murdoch in the Edinburgh Art Gallery. There are also portraits of the Hon. Robert Boyle, F.R.S., James Watt, Philippe Lebon, Frederick Albert Winsor, &c.; a reproduction of the picture of "Scientific Celebrities in 1800," in the National Portrait Gallery, in which James Watt, Boulton, and Wm. Murdoch are included; and numerous illustrations of various apparatus used in the early Manufacture of Gas, with three folding plates, reproduced from the original drawings of Messrs. Phillips and Lee's Mill and the Gas-Works erected there in 1806. In addition to these, there are also views of Bello Mills Cottage, the birthplace of Murdoch, and of the neighbourhood in and around Lugar.

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